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ANALYSIS OF BRIDGE COLLISION INCIDENTS. VOLUME II.(U)

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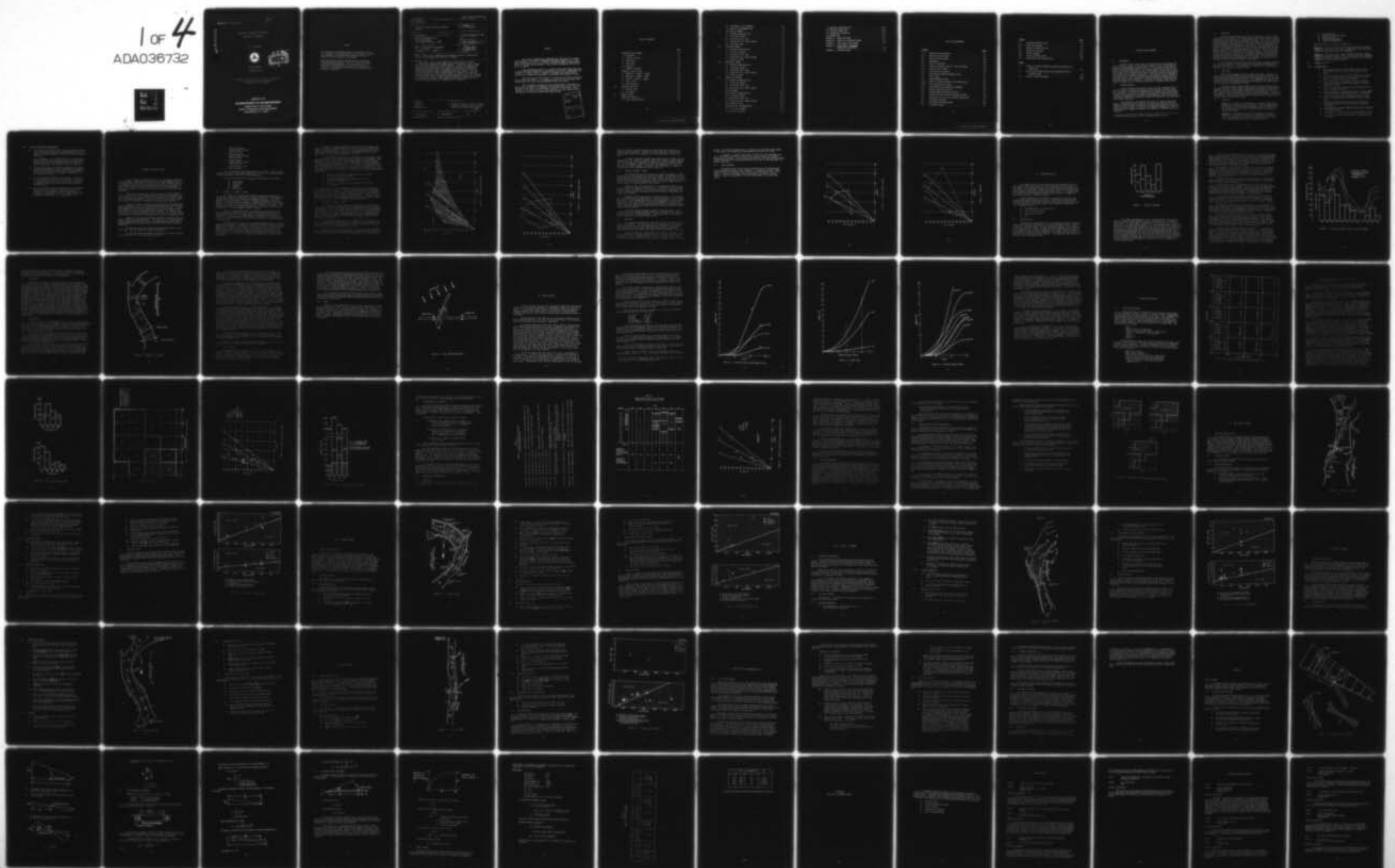

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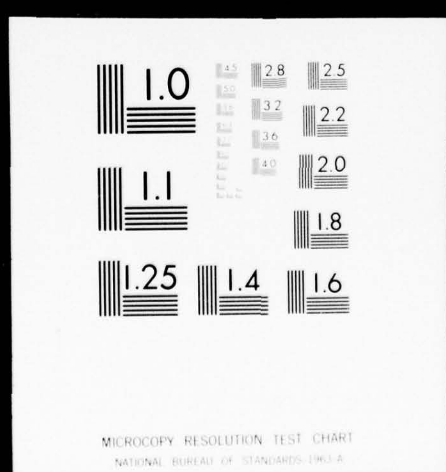

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ANALYSIS OF BRIDGE COLLISION INCIDENTS, VOLUME II

R. B. DAYTON

FINAL REPORT

DECEMBER 1976

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16. Abstract

This report is the second volume in the investigation of towboat collisions with bridges on the inland waterway and western rivers. Volume I was a review and analysis of casualty reports. Volume II supplements and completes the casualty research by technical interviews with experienced towboat captains and pilots. The primary cause of bridge collisions is identified as lack of control in high water and swift currents. The lack of control situation is very briefly analyzed to indicate that there are certain combinations of tow size and current speed that can be very critical. Five bridges are studied in detail including navigation procedures for making the bridge passage safely. The bridges at Berwick Bay (Morgan City) are analyzed and current high water regulations are evaluated.

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PREFACE

This report documents work conducted under Task Order 22, Contract DOT-CG-31446-A. The work was performed by Operations Research, Inc., (ORI) under the direction of LT. L. J. Olson, of the Marine Safety Projects Branch, Office of Research and Development. The principal investigator for ORI was Mr. R. B. Dayton.

ORI is greateful to LTJG. N. S. Porter of the Eighth Coast Guard District for providing information on regulations and traffic at Berwick Bay and to CWO3 W. M. Dukes, Officer in charge of the Morgan City Vessel Traffic System for his counsel and assistance in arranging trips through this area.

ORI also wishes to thank LCDR. W. D. Snider of the Office of Merchant Marine Safety and Captain J. W. Leadbetter and his staff at the Second Coast Guard District for their help and guidance during this program.

ORI is especially grateful to those professionals of the towing industry, both the members of management and the many Captains and Pilots, who provided us with much of the information contained in this report. Their interest in our project and their ready response to our many questions were instrumental in defining a complicated safety problem.

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I. INTRODUCTION AND SUMMARY

1.1 BACKGROUND

The first study in this series is entitled "Analysis of Bridge Collision Incidents, Volume I," and consists primarily of an investigation and analysis of bridge-towboat accident reports. The accident data was helpful in defining the characteristics of the accident population, but was not too helpful in defining the accident cause. Considerable information was lacking such as how a tow is operated under adverse conditions and how environmental and waterway factors affect tow operation. The present study is designed to close the loop by initiating discussions with experienced towboat operators and asking them to help us define the accident problem and suggest solutions that would lead to safer operations. The method selected for obtaining the desired information was to interview operators* by telephone and in person.

1.2 INDUSTRY CONTACTS

Initial contacts were made with towing industry representatives by the Coast Guard to introduce the study, and to gain some insight into how best to proceed. Following the recommendations received, the first presentation was made to the board of directors of the National River Academy, which is made up of executives of the major towing companies. Reaction to the presentation was mixed—some expressing interest and cooperation, and some expressing distrust and alarm.

The presentation was followed up by letters to each of the board members reiterating the main points of the study, and requesting that each company provide the names and addresses of experienced operators in their employ who we could contact. Several of the companies responded with lists of names and helpful suggestions; however, the majority of companies declined to cooperate.

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* The term operator refers to either a towboat captain or pilot.

1.3 INTERVIEWS

Operators were contacted immediately by telephone to establish their acceptance of an interview. All persons agreed, and a date was set for either a person-to-person interview or a telephone interview. Prior to the interview the operators were sent a letter describing the project and a chart of the particular bridge(s) to be discussed. The majority of the interviews were conducted by telephone with the operator at his home. Since the operators work 30 days on the river and 30 days off, interviews were arranged during the off period. We attempted to interview operators in the pilot house during trips through several of the bridges but without much success. There were too many distractions during a bridge passage to properly complete the questionnaire and mark the passage on the chart. The telephone interview proved much more successful because the operators were relaxed at home. Without exception, everyone contacted did an outstanding job in answering our questions and explaining the bridge passage procedure in great detail.

The questionnaire was modified during the project, dropping redundant or superfluous questions in favor of new ones which were identified during the first few interviews. This shortened and streamlined the questionnaire, which was quite long in its original form.

1.4 RIVER TRIPS

Three trips were made to acquaint project personnel, both ORI and Coast Guard, with the towboat, the tow, and operation through a bridge. Two of the trips were made on the Atchafalaya River through Berwick Bay, one downriver through the bridges and one upriver. Both operators took the time to carefully explain the procedure for operating through this area and to point out the location of hazards along the way.

The third trip was made on the Mississippi River through the Greenville and Vicksburg bridges. Both bridge passages were made at night and the operators provided a lucid commentary describing the problems of night navigation in bends and cross currents, and poorly illuminated bridges. This trip was especially interesting because it pointed out the difficulty in establishing the position of the tow in the channel and of determining the lateral and rotational motion of the craft at night.

1.5 APPENDICES

Appendix A: contains the development of an analytic model and an example using a typical tow configuration. The model demonstrates the effects of external forces and moments on the tow and the corrective results as a function of operator actions with steering and propulsion power.

Appendix B: a literature search was conducted in an attempt to find data on river piloting operations, procedures and training. Very little information was found on these specific topics, however information was obtained on the following items:

- Accident/Safety
- Performance/Advanced Systems
- Analysis/Design
- Transportation/Commerce
- General Background Data

Brief abstracts are contained in Appendix B.

Appendix C: the casualty data base has been updated with accident reports for fiscal year 1975. This information has been transferred to data forms which are contained in Appendix C.

Appendix D: the regulation of vessel movement through the bridges at Berwick Bay began in January 1973. Accident data during regulated periods is analyzed in Section 5.0 and the regulations (Local Notice to Mariners) are reproduced in Appendix D.

1.6 SUMMARY OF RESULTS

1.6.1 Accident Cause

- The primary cause of accidents (93%) is due to being out of control (out-of-shape) on the approach to the bridge.
- In 73% of the cases the out-of-shape situation is the result of a rotation and/or set in a current field and a delay in recovery action by the operator.
- One of the reasons for delayed action by the operator is the difficulty in perceiving the onset of rotation, especially at night.
- The forces that cause rotation increase linearly as the angle of rotation increases.
- There is evidence in many scenarios that a critical angle of rotation can be reached where recovery is impossible.
- In 20% of the cases the out-of-shape situation is the result of rotation and/or slide due to wind on an empty tow.
- Many wind-caused accidents are due to a unique set of conditions at specific bridges and must be addressed individually.
- The majority of accidents happen during extreme conditions of current and wind.
- The majority of current-caused accidents happen at night.
- The majority of wind-caused accidents happen during daylight hours.

1.6.2 Accident Reduction Recommendations

- The accident rate at Berwick Bay could be reduced by replacement of existing regulations by a new regulation similar in content to the one proposed in Section 5.3, Regulation Recommendations.

- Strict adherence to the "guideline curves" at other bridges would be effective in reducing accidents, although these bridges lack the volume of supportive data that were available at Berwick Bay. See Figures 6.2, 7.2, 8.2 and 10.2.

- Follow-up and analysis of operator suggestions for a safer passage and implementation of the most pertinent suggestions would provide for better navigation with the potential for accident reduction at specific bridges. See Sections 6.4, 7.4, 8.4, 9.4, and 10.3

- The "out-of-shape" condition is the precursor of being out of control possibly resulting in an accident. The design of instrumentation to measure and signal this condition to the operator (especially at night) could reduce accidents. See Section 11.1.

- Many of the bridge navigation problems could be eliminated by the design of a navigation system which specifically addresses the unique aspects of the bridge passage, i.e., the approach, the bridge, the current, channel, shore characteristics, river traffic, etc. See Section 11.1.

II. SUMMARY OF CASUALTY DATA

Casualty data was displayed in Volume I as "Tow Makeup Guidelines" for each bridge. Deadweight, tow length and horsepower parameters were used to designate "safe" and "unsafe" operating zones. Some similarity of the curves between bridges and similar waterway characteristics was noted. For example, the Greenville and Vicksburg bridges both have upstream bends in the river just above the bridge, and the guideline curves are almost interchangeable.

Both upriver and downriver casualty cases were plotted together in Volume I, and it was noted in several instances that this was probably not a valid procedure since tow control operation would not be the same in each case. The downstream passage is a much more sensitive and difficult operation based on the numbers of casualties and interviews with operators.

It was also unclear if casualties caused by wind and current should be plotted together. Many of the wind caused accidents were due to the tow being stopped dead in the water and waiting for a bridge to open. Also the great majority of wind caused accidents were to empty tows which have very little draft (1-2 feet) and poor directional stability. In addition, the relatively high freeboard (10 feet or more) acts like a sail in the wind and the tow tends to slide and/or rotate when the wind velocity exceeds 15 knots.

Loaded and empty tows have different behavioral characteristics and probably should be plotted separately. The empty tow is easier to stop and steers quicker but slides faster than the loaded tow which is difficult to stop during downstream operation and responds much more slowly to steering corrections.

The data base used in this section has been updated with FY75 casualty data. FY75 data forms are contained in Appendix C.

The following subsections address these unresolved areas by displaying the casualty data in the following combinations:

1. Downriver passage
   Accident cause - Current
   Loaded condition
2. Downriver passage
   Accident cause - Current
   Empty condition
3. Upriver passage
   Accident cause - current
   Loaded condition
4. Accident Cuase - wind
   Empty condition.

It is interesting to note that there were no upriver - empty accidents, however, there was a single partly-loaded case. Also, all of the wind-caused accidents were empty except for a single loaded case.

The data base consists of accidents at the following five bridges:

- Fort Madison
- Greenville
- Vicksburg
- Decatur
- Berwick Bay.

2.1 DOWNRIVER - CURRENT - LOADED

This data base is comprised of downriver passages (proceeding with the current), primary accident cause is current, and all cases were loaded tows. Data has been plotted on tow length and horsepower parameters. The numbers adjacent to each data point in Figure 2.1 represent the number of barges in the tow. As noted previously in Volume I, length does not tell a very complete story since a 1000 ft.-long tow could consist of 5 barges or 25 barges. Therefore, we shall attempt to overcome this weakness in the length parameter with the addition of a third parameter, numbers of barges.

Figure 2.1 displays this data. Data points on the perifery of the pattern have been connected to form a shape which can be compared with the data patterns to follow. It is hoped that by a comparison of the shapes of the patterns and the location of the shapes on the grid we can draw some conclusions as to the relative merit of handling the various data groups separately or in combination.

The bands shown in Figure 2.1 are included to demonstrate areas of tow length and horsepower as a function of the width of the tow in numbers of barges abreast. For example, in the "single string" case the lower three data points representing a single barge are for the standard 195 ft. hopper barge. Multiples of this standard barge are shown by data points at tow length of 400, 600, and 800 feet. The cluster of these data points representing two barges at tow lengths of about 600 ft. are probably tank barges whose standard length is 290 feet.

The bands representing numbers of barges abreast are based on the numbers of barges at a representative data point and the given length associated with that data point. The division lines between bands and slope of these lines are in most areas based on very few data points and are only approximate. Lines of HP/L are shown for reference.

It is interesting to note that at the lower horsepower figure, there is a rather wide vertical spread in tow length for the same horsepower. For example, we have a group of four single-barge accidents at about 750 hp and 200 feet in length. We also have tows of 400-, 600-, and 800-foot lengths for that same relative horsepower. It is not difficult to understand why the three four-barge tows got into trouble, but it is hard to understand how the four single-barge tows had trouble. This spread in length range in the lower horsepower tows is difficult to explain. One or more of the following thoughts may be valid:

- Operators of the smaller towboats are not as skilled as operators of the larger ones
- The smaller towboats are the older ones and have a lessor control capability
- Variations in current velocity account for the spread in tow length.

We know that accidents happen at various current velocities, but unfortunately, we don't have sufficient and reliable current velocity data to incorporate this parameter. It would seem logical that the single-barge tows ran into trouble during periods of maximum current flow, and that the four-barge tows had trouble at lessor current velocities. In fact, the four-barge tows have a HP/L ratio of approximately one, and are probably incapable of reasonable control even at the lowest current velocities.

2.2 DOWNRIVER - CURRENT - EMPTY

This data base is made up of accident cases making a downriver passage, primary accident cause current, and all barges were empty. The data is shown in Figure 2.2 and the pattern has been enclosed with a line connecting the perimeter points. The shape of this pattern is quite different from the loaded patterns of Figure 2.1. Note the absence of higher horsepower cases. It is not known if this means that the higher horsepower towboats pushing empties do not have accidents or if the higher horsepower towboats do not push empties downstream.

The maximum number of barges (in a single tow) in our sample is 13. This is considerably less than the maximum number in the loaded sample (35). One similarity with the loaded sample is the number of smaller (2, 3 and 4) barge tows in the 500 to 2,000 horsepower range.

A surprising aspect of this pattern is the longer tows in the 500 to 3,000 horsepower range. The opposite might be expected for empty tows due to the tendency of wind forces to slide and rotate an empty tow. Shorter tows

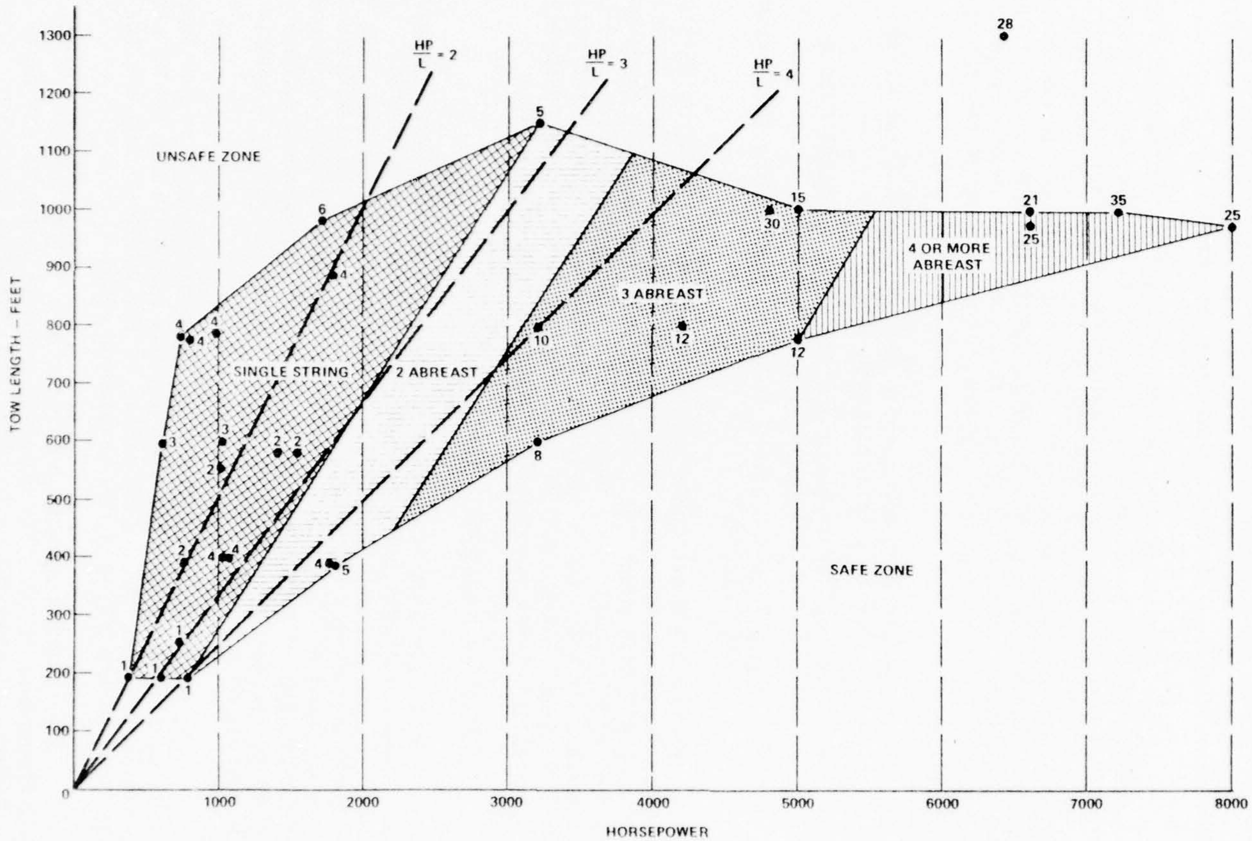

FIGURE 2.1. DOWNRIVER-CURRENT-LOADED

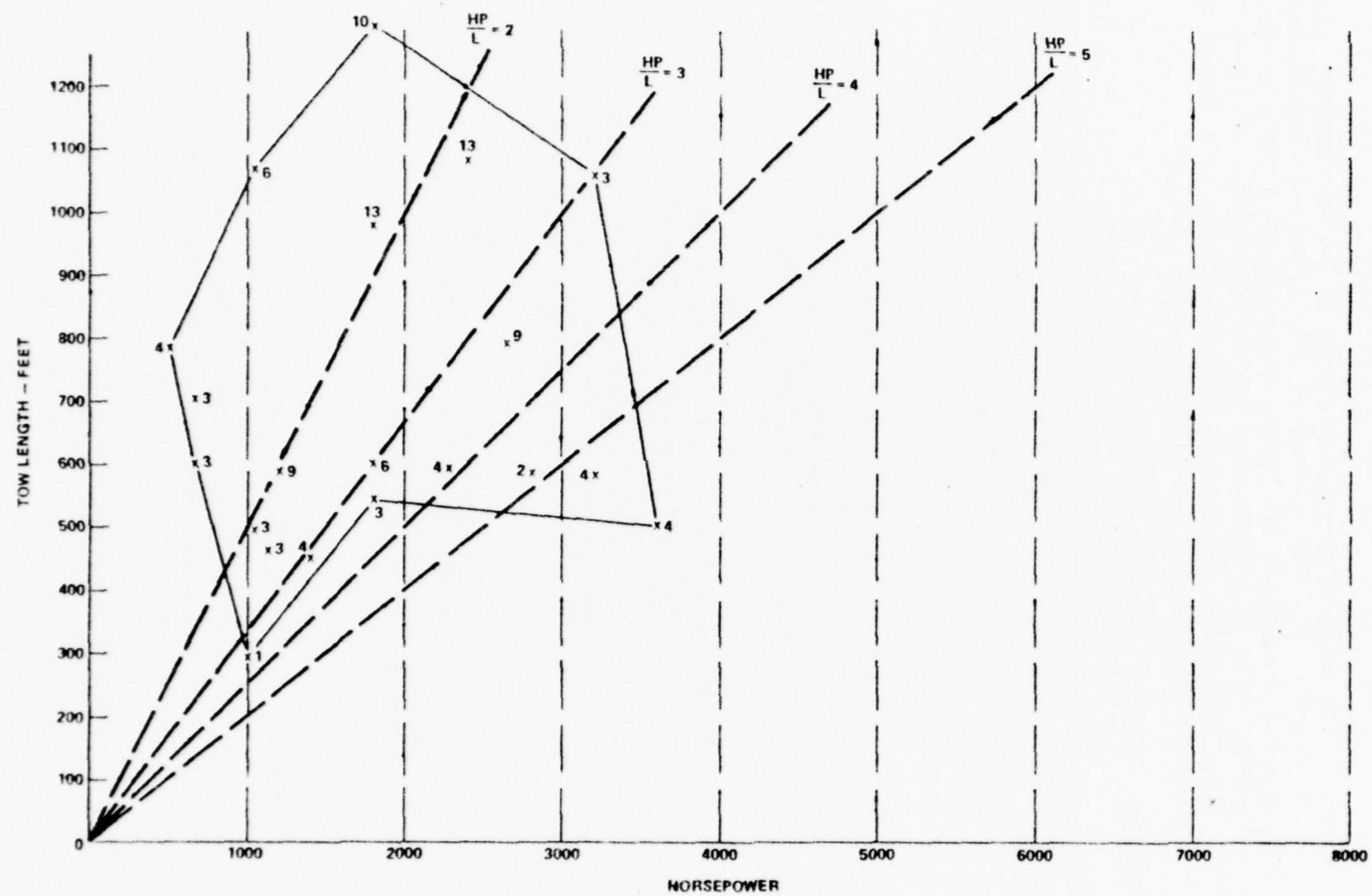

FIGURE 2.2. DOWNRIVER-CURRENT-EMPTY

ought to be easier to control because of shorter moment arms resulting in smaller upsetting meoments. Possibly the longer tows were required due to some characteristics of the waterway such as a bridge which restricts tow width.

In general, the empty accident cases seem to be less orderly than the loaded cases. For example, an 1800 hp towboat will attempt to handle anywhere from 3 to 13 barges and throughout the sample the range in numbers of barges for a given horsepower is much greater than the loaded sample, at least for tows less than 3000 horsepower. It appears that the makeup of a loaded tow is given more serious consideration than an empty one.

2.3 UPRIVER - CURRENT - LOADED

The accident base for this situation, as might be expected, is small. The passage is upriver against the current and loaded. The deep draft in the loaded condition and the relatively high water velocity creates high resistance to forward motion and during high river stages the over-the-ground velocity may only be a few miles per hour especially in the vicinity of bridges which are often located in a narrow section of the waterway.

Stopping is not the problem here as in the downstream passage since it only requires the removal of forward thrust. Strong cross currents however, present a serious problem due to the slow passage past the bridge piers and out-of-alignment with the current flow can cause the tow to "top-around" completely out of control.

The data base for these cases is plotted in Figure 2.3 and includes only six accidents over the sample period. Tow length appears to be important. Note that all cases exceeded 600 feet in length and apparently involve single string tows. The single string is certainly recommended to minimize hydrodynamic resistance over the long upstream haul, but for a safe bridge passage a length reduction would significantly reduce the upsetting moment and provide better control capability.

There were no empty upstream casualties in the data base. This is probably due to the lower hydrodynamic resistance, shallower draft, and the resulting reduction in upsetting moment. All of these factors contribute to quicker response to steering and better control.

2.4 WIND-EMPTY

This data base is made up of cases where wind forces were the prime cause of the accident. All cases were empty and the direction of travel upriver or downriver was of no consequence because current was not involved. The directional control of empty tows becomes very sensitive when wind velocities exceed 15 knots due to the shallow draft of the barges (1 to 2 ft).

Figure 2.4 shows the accident data base. There is a cluster of data points in the lower horsepower range of 600 to 1000. Both single string and two abreast tows are represented in this cluster. The three larger tows of 12, 13 and 16 barges each were forced to come to a complete stop at a railroad

bridge. Even large horsepower tows are vulnerable to wind forces when stopped in restricted areas because they loose steerage and directional control.

In general, it appears from Figure 2.4 that the lower horsepower tows (less than 1000 hp and HP/L less than 2) are the major sources of accidents during windy conditions. This may be because these are the older towboats without effective steering and flanking systems and/or the lack of sufficient power for weather conditions.

2.5 DATA CATEGORIES

The general forms of the plotted accident data do not indicate much if any dependency between the data categories. The downriver-current loaded category (Figure 2.1) appears to be the best controlled because there is evidence of a relationship between length, horsepower, and numbers of barges (width). There is no evidence of a similar relationship in the other categories.

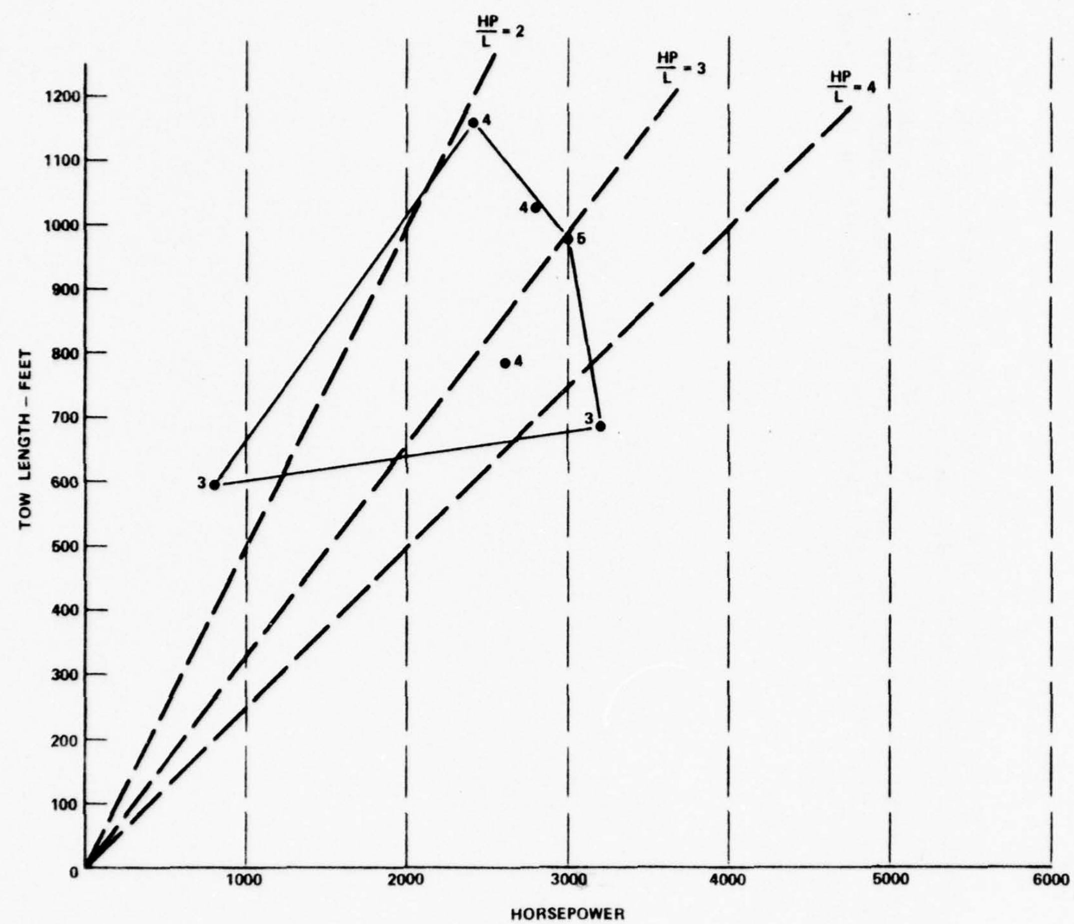

FIGURE 2.3. UPRIVER-CURRENT-LOADED

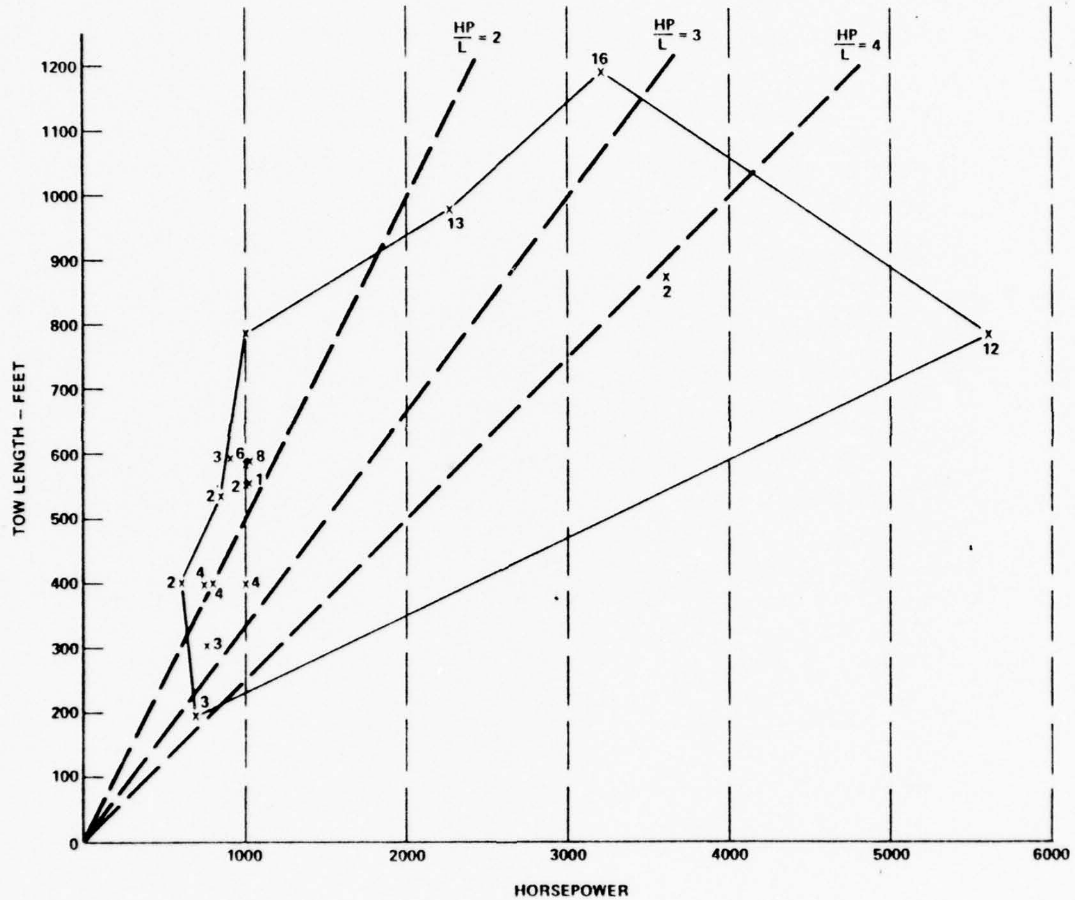

FIGURE 2.4. WIND-EMPTY

III. PROBLEM DEFINITION

The casualty reports are not much help in problem definition. Casualty cause information is usually brief and completely lacking in detail. This appears to be standard procedure in accident reporting resulting in part from painful past experiences in which the more conscientious and responsive towing companies found their own data used against them. As a result of this, only sketchy and often misleading accident cause information is supplied, which does not begin to define the problem.

Missing information and accident cause details have been provided by experienced towboat captains and pilots. Information supplied by these professionals helped clarify the accident situation and explained many of the confusing aspects of the accident reports which frequently contain terse casual statements such as:

- Misjudged effects of current on tow
- Cross current at bridge
- Sudden gust of wind
- Etc.

3.1 ACCIDENT CAUSE

The majority of towboat operators and management personnel interviewed contend that the cause of accidents is a function of operator skill. Don't confuse skill with experience. The most experienced operator is not necessarily the most skillful. Figure 3.1 shows that 30% of the operators in our casualty sample have over 20 years experience, and 28% have from 6 to 10 years of experience. Note that this is experience as a towboat captain or pilot, and does not include time in any other capacity. It would appear that lack of experience is not an important factor.

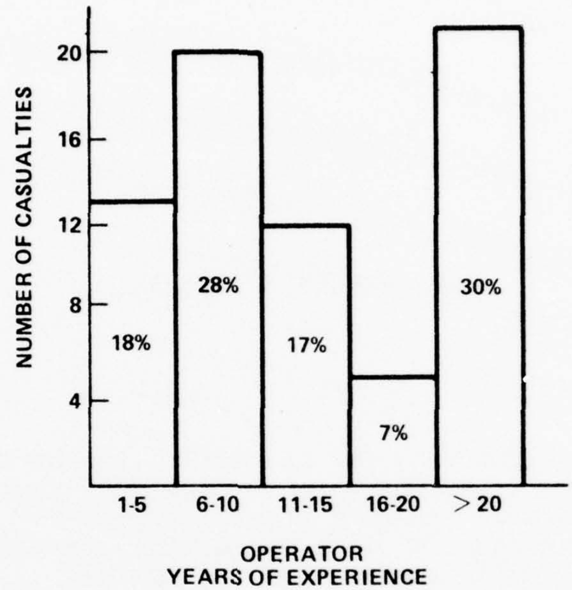

FIGURE 3.1. YEARS OF EXPERIENCE

The further consideration of skills versus experience brings up the question, could a towboat operator lacking in the skills of his profession really attain 10 or more years or experience in that profession? It doesn't seem likely. The river towing industry is an old, proud and highly competitive industry. They compete among themselves and with other modes of transportation for survival. It would seem logical then that only the most skilled would be entrusted with what at times must seem like an awesome responsibility, that of piloting 40,000 deadweight tons, in a narrow and restricted waterway, downstream in a 10 knot current, at night, with only 6000 horsepower and the whole rig tied together with wire rope. This picture is both amusing and frightening. Could a reasonable operations manager really place a pilot of mediocre skills in such a position? If the anwer is no then skill is not a prominent part of the accident problem.

Continuing in our effort to find cause we shall investigate the human aspects of this operation. Please note that a treatise on human factors and/or human engineering is beyond the scope of this study so our discussion will be more observation than scientific. Even the basis for making observations is limited to four rides on tows thru five bridges, three during the day and two at night, interviews with approximately 25 operators and discussions with Coast Guard personnel and industry management.

In comparison to an ocean-going vessel, the pilot house of a towboat appears to be compact, efficient and well-arranged. Unlike the ocean-going pilot house it is arranged for one-man operation. The pilot is comfortably seated at a control console and is in complete control of engine thrust and steerage. He has 360° unobstructed view from the pilot house which is located well above the tow.

Living quarters appear adequate in size but rather grim in amenities. Food is reported to be excellent in both quantity and quality. Recreational facilities appear to be non-existent.

During the make-up of a tow the operator is a very busy man. The operation requires that specific barges be broken out of an anchorage, ordered in the tow and securely lashed together. This requires constant operation of the engine and steering controls, communication with the deck crew and operation of two search lights (at night). Once underway with the tow the operation settles down to normal navigation and course keeping.

To the uninitiated, night navigation appears to be an impossible task. Few navigation aids mark the channel and the searchlight is employed to judge distance from shore or shore structures, and to pick up infrequent buoys. The radar and radio are used constantly to verify the tow's location and to identify local traffic.

Some operators report that a bridge passage is anticipated days in advance and prepared for miles in advance especially during high water. The implication is that there is some degree of psychological strain at the thought of an impending bridge passage, the degree of which is probably dependent on river stage, the tow size and the particular bridge.

In spite of testimony to the contrary, it is not evident from the data that operator skill is the primary cause of bridge accidents. The primary cause is identified in the casualty reports although it could not be interpreted until the operator interviews defined it for us. They both identify the primary cause as lack of control under extreme conditions of current which are encountered during high river stages four or five months per year or extreme wind conditions which occur on a more random basis.

Monthly casualty numbers are shown in Figure 3.2. The casualties shown are current-caused and cover the period FY 70-74. Superimposed on the casualty bar chart are three curves representing Mississippi River discharge rates. The three curves represent the monthly maximum, mean, and low readings for 1972 thru part of 1973. Comparison between the casualty data and the discharge curves can be made with caution as long as one assumes that the curves are representative of the average seasonal river conditions within reasonable limits and that this average is applicable during the period covered by the casualty data base. Inspection of Figure 3.2 indicates that this assumption

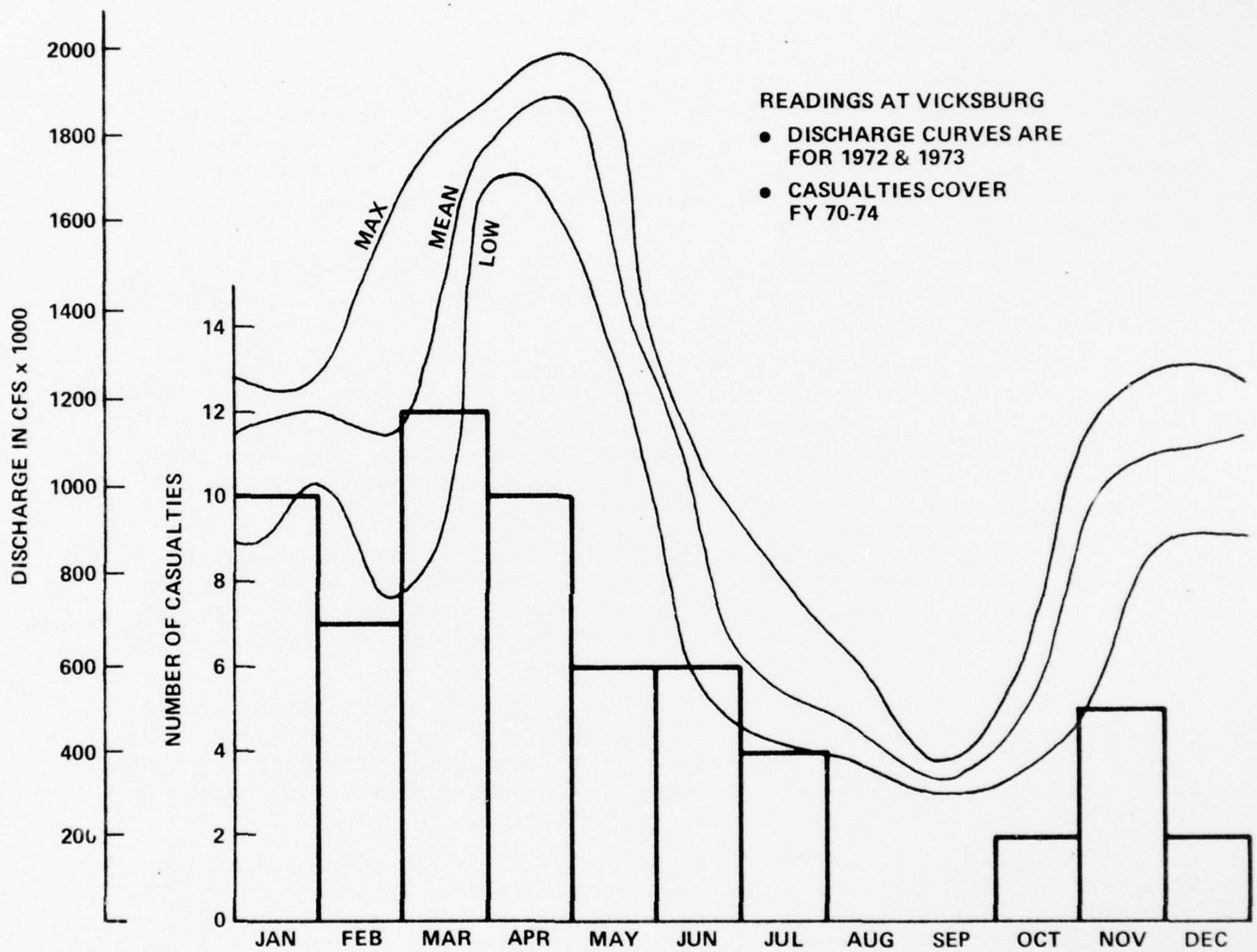

FIGURE 3.2. DISPLAY OF CASUALTY RATE VS. RIVER DISCHARGE

is a good one because the tops of the casualty bars closely trace out the general form of the discharge curves. This data, in effect, substantiates the casualty reports and the operators input that tow control, or the lack of it under extreme conditions is the most serious problem.

3.2 TOW CONTROL

Steerage is provided by the towboat except in a few instances where bow steering units are utilized. The towboat is located at the stern of the tow. The great majority of towboats have twin screws with two steering rudders located behind the screws and four flanking rudders located ahead of the screws. The steering rudders are used for course keeping and maneuvering when the propellers are producing forward thrust. The flanking rudders are used for maneuvering when the propellers are producing astern thrust. Under normal conditions the towboat is a very capable prime mover and years of design evolution have produced an efficient vehicle well adapted to its operating environment. The extremes of this operating environment produce some control problems. Unfortunately these extreme periods last for 3 to 5 months each year as attested by Figure 3.2. This situation is unique among transportation systems. Other systems (aircraft, railroad, truck) must also contend with extreme conditions but only for brief periods lasting hours or possibly days for a severe storm at sea. The towboat however, can expect to operate a third of every year under extreme current conditions with additional random exposure to extreme wind conditions. Operation under these extreme conditions can possibly be made safer if we can describe the scenario which precipitates the accident situation. This scenario has been vividly provided by the operators and substantiated by the casualty data.

3.2.1 Out-Of-Shape

Characteristically the out-of-shape situation occurs at a bend in the waterway. It can also occur in cross currents and in sections of variable current flow. The initiating factor is the position of the tow in relation to the current flow lines. If the longitudinal axis of the tow is not parallel to the flow lines, current forces will create an upsetting moment which tends to increase the out-of-alignment condition.

This condition can be aggravated if there are varying current forces over the length of a tow. The situation is depicted in Figure 3.3 which shows a typical waterway bend complete with current fields and a tow proceeding downstream. Typical bend configurations such as this are found upstream of the Vicksburg, Greenville and Berwick Bay bridges. The waterway shown in Figure 3.3 is the upstream segment of Berwick Bay.

As the current rounds the bend in the river the higher velocities occur at the outer periphery of the bend. Lower velocities are encountered on the inside of the bend and in some instances the shape of the bank creates slack water and eddies. The direction of the current flow is angled slightly toward the outer river bank and just below the bend the flow is directed toward the opposite side of the river as shown in the vicinity of the bridges in Figure 3.3.

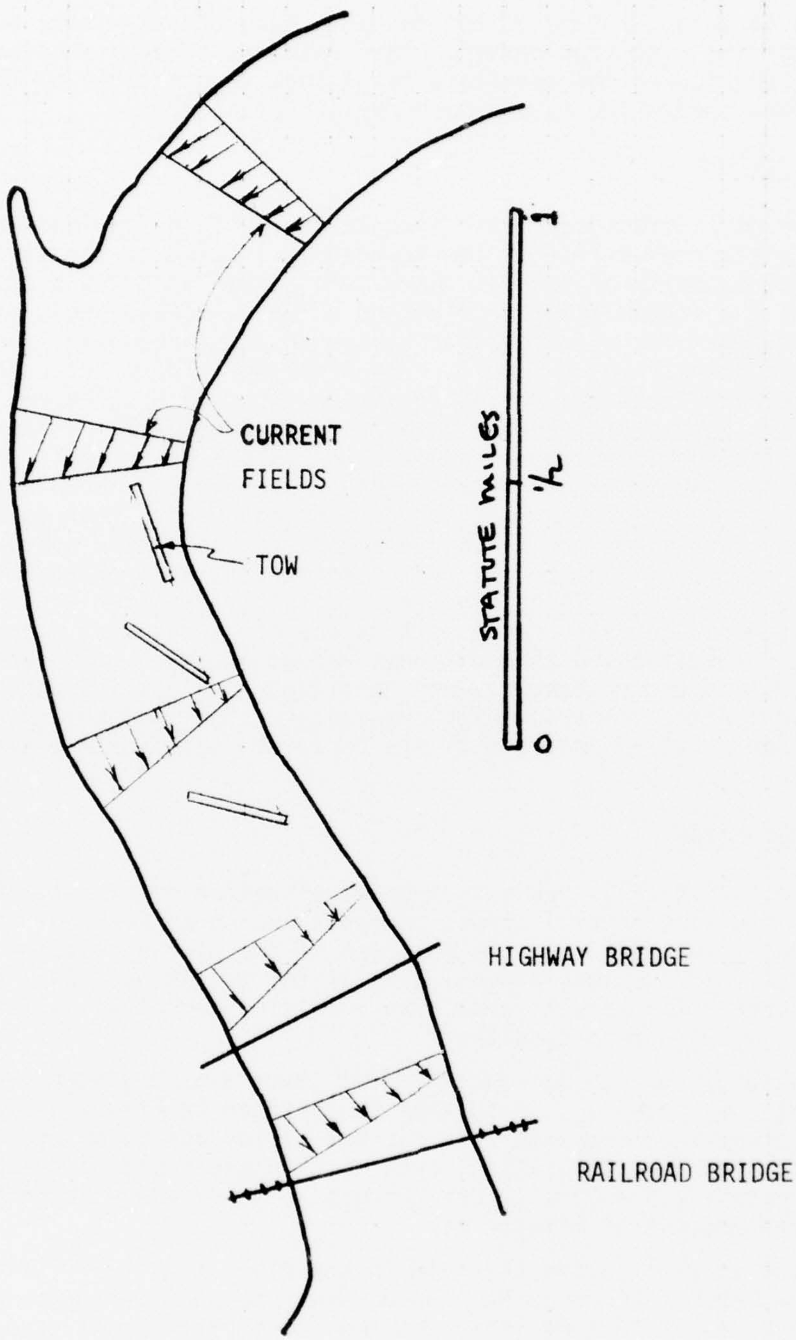

FIGURE 3.3. CURRENT FIELD IN BEND

The proper procedure for rounding the bend during high water is to hold close to the inside bank (if water depth permits) and to proceed slow ahead with just enough speed to maintain adequate steerage. If the bend is negotiated at high speeds, the combination of current and centrifugal force would sweep the tow out into the river toward the outside shore and it would be almost impossible to make the bridge passage from this position.

Rounding and coming out of the bend is the most critical procedure. The tow must hold the inside bend and as a consequence does not align with the current flow. This is shown in Figure 3.3, creating a situation whereby the stern of the tow is in a stronger current field than the bow plus the direction of the current forces on the stern tends to push the stern toward mid-river and to rotate the tow counterclockwise. If the operator does not react in time to counter this movement or if there is not sufficient restoring power to counteract it, the tow will rotate until broadside to the current flow and float down on the bridge completely out of control as depicted in Figure 3.3. This rotation in the current is called being out-of-shape. The brief commentary in the accident reports such as "misjudged effects of current on tow" probably means that the operator got out-of-shape in the bend a mile above the bridge and could not recover in time to make the bridge passage safely.

Unless the recovery action is initiated immediately, it is difficult to recover at all because the upsetting moment increases as the angle between the longitudinal axis of the tow and the current flow lines increases. Also as the angle increases the recovery options go from three possible actions, i.e., drive ahead and steer back on course, reverse and flank back on course, reverse to kill all forward motion and stop, to just the latter two. As the angle gets bigger, the operator can't drive ahead without running into the bank, so the only remaining maneuvers are to reverse and flank back into position - then to drive ahead to regain steerageway in time for the bridge passage, or to stop completely. Given sufficient power and distance to the bridge or other obstruction, either is a likely course of action, but the operator must have both distance and power because it takes both time and distance to stop with the current behind the tow, and it takes both time and distance to attain sufficient speed to regain steerage.

The operators report having used all of the recovery actions listed above to avoid potential bad situations. One or more of these maneuvers may be required depending on the problem at hand, tow characteristics, horsepower, river width, current, etc.

From all indications, the out-of-shape phenomenon is the most crucial problem the tow will encounter during high water conditions.

3.2.2 Cross Currents

Cross currents seem to exist at all of our critical bridges. It is unknown if bridges are built over cross currents, or if cross currents are the result of bridges—probably the former. The current may cross the river in the vicinity of the bridge as shown in Figure 3.3, or the bridge may cross the river at an angle to the current requiring the tow to cut across the normal flow in order to make the bridge opening.

At any rate, the tow must be in the right position before entering the bridge span. This position is anticipated many miles upstream of the bridge and the navigation efforts of the operator are directed toward arriving at the bridge in precisely this position in order to make the passage safely. When the river stage is high the tow will pass close to the pier at a slight yaw angle to counteract the the set of the current. This situation is shown in Figure 3.4. The operator must drive hard (fullpower) through the bridge span in order to keep from being swept down on the opposite pier by the cross current. Figure 3.4 shows an example of current V_c, and ship V_s, velocities and directions including the relative velocity, V_r, which is the over-the-ground velocity and direction of the tow with respect to the bridge piers.

Cross currents are especially difficult where there are two bridges within a few hundred yards of each other or some other obstruction or waterway characteristics above or below the bridge which makes both the entrance and exit operation very precise.

3.2.3 Wind

Operation in wind with empties is not unlike operation of a loaded tow in a cross current. When the tow is empty it has a high freeboard (10 ft) and minimal draft (1-2 ft). The wind pressure over the sides of the tow and the deck protrusions will cause the tow to slide sideways over the water and to rotate. This is especially serious during slow speed operation or when dead in the water. Most operators tend to drive empty tows at high speeds in order to increase hydrodynamic drag which improves the directional stability and steerage.

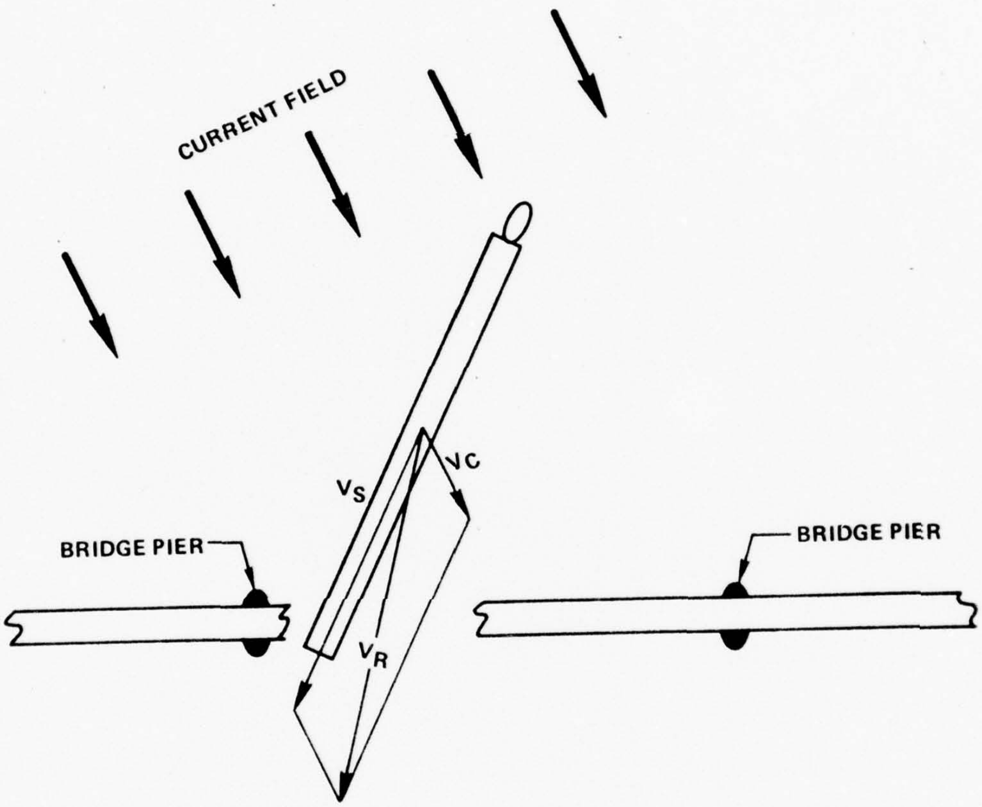

FIGURE 3.4. CROSS CURRENT NAVIGATION

IV. ANALYTIC MODEL

A simple analytic model has been developed to demonstrate the physical aspects of the out-of-shape condition. A hypothetical towboat and tow can be placed in a pre-defined current field for calculation of both the upsetting moments created by the current field on the tow and the restoring moments created by the actions of the operator using the power and steering systems on the towboat.

The development of this model was not an exhaustive undertaking and many assumptions were made due to the lack of technical data in the literature. Details of the analysis are contained in Appendix A.

The model was designed around river current, waterway characteristics and accident characteristics which are typical at Berwick Bay and other locations. The current field varies in velocity representing conditions in a bend where velocities at the outside of a bend are significantly higher than those on the inside of the bend were slack water and eddies are not uncommon. During high water the tow will steer around the inside of the bend at speeds just sufficient to maintain steerage in order to prevent centrifugal forces from forcing the tow to slide out farther into the center of the river. As the tow proceeds deep into the bend its longitudinal axis becomes misaligned with the current field flow lines. In the bend the flow lines tend to cross the river towards the outside of the curve. The tow which is following the inside of the curve, in the slower water, encounters current velocities at the stern which are higher than those at the bow. The current field defined by the model reproduces this situation to any degree desired. That is, the current field can be defined to fit the situation.

The current pattern over the length of the tow is created when misalignment occurs. A simple triangular pattern is assumed whose magnitude is a function of the degree of misalignment and the average current velocity at the center of the tow. Net current forces are perpendicular to the sides of the tow. Only those forces on the tow which produce rotation are considered by the model. Hydrodynamic forces along the longitudinal axis are not included.

The current pressure along the sides of the tow cause it to rotate until broadside to the current field or until fore and aft pressures are equalized. The magnitude of these pressures is based on drag coefficients for blunt forms (barges) obtained from Hoerner.[1] The drag of a tow or any other vessel moving sideways thru the water is not readily available in the technical literature and assumptions had to be made based on the best available data.

The restoring forces and moments are created by the thrust and control actions of the operator. Thrust values were calculated based on pounds of thrust/horsepower which are typical of icebreakers. The operation of towboats and icebreakers is very similar, both must produce high thrust at low vessel speeds, so it was assumed that the propellers of each would be designed on a similar basis. Any value can be used; however, a 20#/HP was selected for the example worked out in Appendix A.

Operator response to a swing or rotation is a mystery. What action would be taken and how can it be defined? The response curve finally selected was possibly too severe but was easily defined by a simple sine relationship which included both thrust magnitude and angle.

Model results are displayed in Figures 4.1, 4.2 and 4.3, using the following tow characteristics as an example:

Tow Length	= 500 feet
Tow Beam	= 35 feet
Tow Draft	= 9 feet
Tow Horsepower	= 1,000
Current Velocity	= Variable.

These characteristics are typical of the tows that operate through the Berwick Bay area and represent the majority of our casualty sample. The example is used to demonstrate the output of the analytic model and to show the relative relationships between the physical factors which produce an out-of-shape situation.

Curves of upsetting moment M_u, and restoring moment M_r, are shown in Figure 4.1. M_u and M_r cannot be compared as shown because it is unlikely that the operator response which produces M_r would be coincident with the upsetting moment M_u.

Cross curves are plotted in Figure 4.2 on a base of current velocity. These curves are used to obtain intermediate current velocity data points and to check the fairness of intermediate points on the curves.

Figure 4.3 shows the moment curves on an enlarged ordinate scale. Upsetting moment curves for 4, 6, 8, and 10 knots are shown with three delayed

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[1] Dr.-Ing. S.F. Hoerner, Fluid-Dynamic Drag. Hoerner Fluid Dynamics, 2 King Lane, Greenbriar, Brick Town, New Jersey 08723.

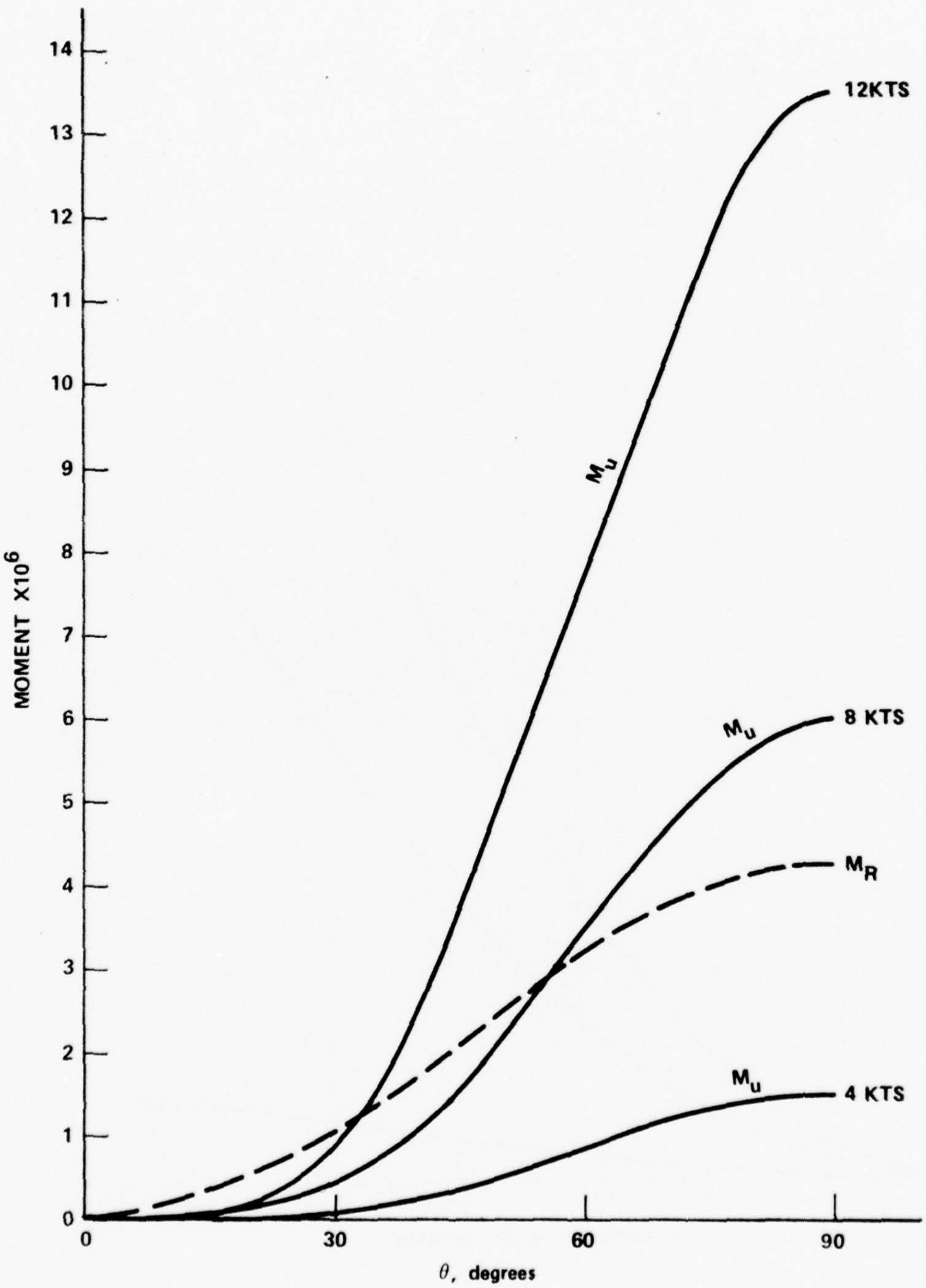


FIGURE 4.1. UPSETTING AND RESTORING MOMENT CURVES

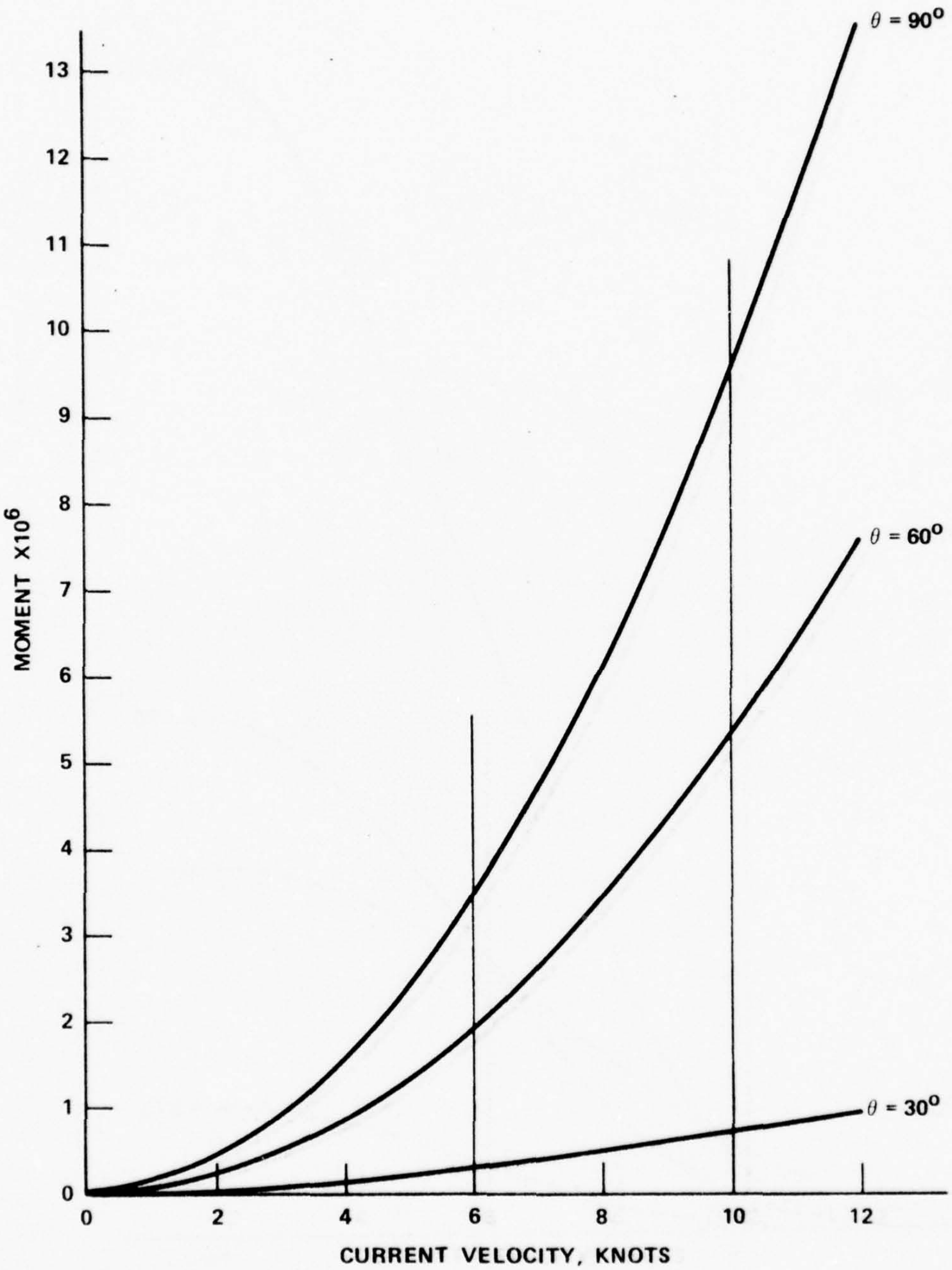


FIGURE 4.2. CROSS CURVES

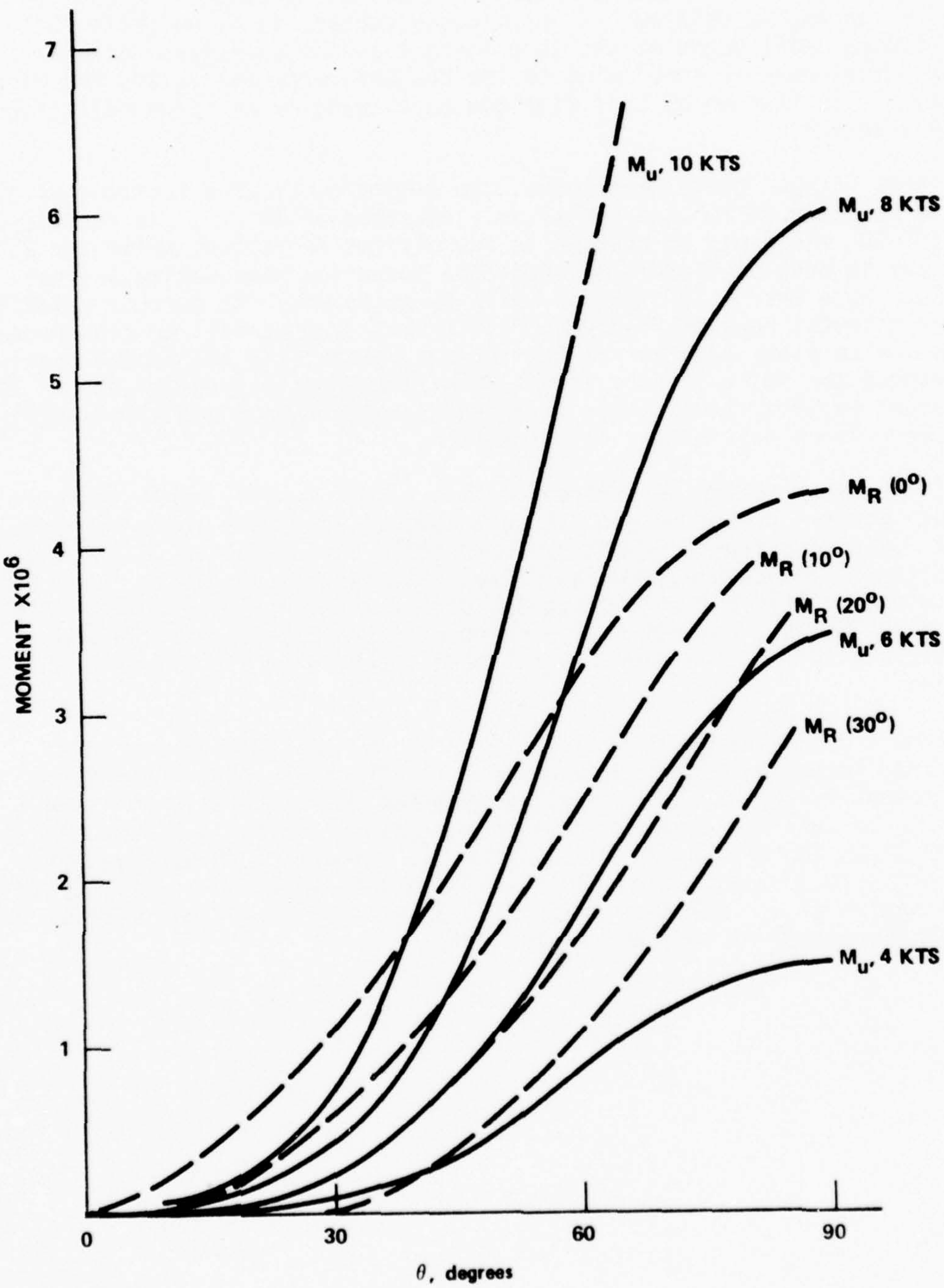


FIGURE 4.3. DELAYED RESPONSE CURVES

restoring moment curves which begin at $\theta = 10^\circ$, 20°, and 30° represented by curves $M_r(10^\circ)$, $M_r(20^\circ)$ and $M_r(30^\circ)$. The reason for displaying the response curves at delayed θ's is to demonstrate the relationship between M_u and M_r as operator response is delayed. As previously stated, it is unlikely that operator response will begin at the same instant as the upsetting motion. The operator must observe some swing to the tow before he recognizes the need to correct. It is unknown at this time how much swing or rotation will trigger his response action.

Three delayed curves are shown, one beginning after a rotation of 10°, one after a rotation of 20° and one after a rotation of 30°. It is anticipated that the 10°-20° range may be reasonable for daytime operation, while the 20°-30° range may be more applicable to nighttime operation when motion is less discernible. Note that a 10° response will be successful for current velocities of 4, 6 and 8 knots; however, recovery in an 8 knot current will be slow because the curves are so close together at the lower θ values (the net moment magnitude to reverse the swing is only about 30% of the upsetting moment at $\theta = 30^\circ$). If the current velocity is 10 knots and recovery action does not start until $\theta = 10^\circ$, there is no possibility of correction.

If recovery action is delayed until $\theta = 20^\circ$, $M_r(20^\circ)$, the situation becomes much worse. Upsetting and response moments are equal for a velocity of 6 knots. Recovery from a 4 knot current should be no problem, but 8 and 10 knot currents are impossible, and the 6 knot situation is marginal. At 6 knots the angle θ can be held but no improvement can be made until the current field changes for the better, maximum restoring moment is applied, or a flanking maneuver is instituted. Flanking has not been included in the analytic model at this time.

At $\theta = 30^\circ$ recovery is impossible for 6, 8, and 10 knot currents unless maximum restoring moment is applied. In all cases, once the maximum restoring moment is applied, recovery can be expected in currents of 4 and 6 knots as long as sufficient maneuvering room remains. There is a component of forward thrust at the maximum thrust angle of 40° producing forward velocity which may prove to be unacceptable in restricted waterways and especially at the higher angles of θ. The result of this forward motion may be to drive the tow into shallow water or some shore structure.

V. BERWICK BAY ANALYSIS

5.1 TOTAL POPULATION DATA

One valuable piece of information which is lacking in the bridge collision analysis contained in Volume I is a description of the population of tows which pass thru these bridges without mishap. This information has now become available at Berwick Bay due to the recent installation of a Vessel Traffic System (VTS) and the documentation of all passages by the traffic control operator. Data has been obtained on all tows passing thru the railroad bridge during the period February 1975 to January 1976. The following data is recorded:

Date
Name of vessel and horsepower
Number of barges, length, empty, loaded, mixed
Direction, integrated or non-integrated
Trips
Assisted by
Remarks.

Horsepower and tow length data have been extracted from these records to establish the character of the safe passage population and for comparison with the casualty population. The data is arranged as shown in the matrix Figure 5.1A where the following information is given for the period February 1975 through January 1976.

Number of collisions
Total number of passages
Number of tows split up (to take a lesser number of barges thru the bridge during high water)
Number of tow assists (a second towboat usually secured at the head of the tow is used for added control)

HORSEPOWER		TOW LENGTH, FEET 101–401	401–701	701–1001	1001–1301
4001–5001	Collisions	0	0	0	0
	Total Passages	0	41	107	241
	Tows Split	0	4	8	21
	Tow Assists	0	4	6	21
	Prob. of Coll.	0	0	0	0
3001–4001	Collisions	0	1	0	0
	Total Passages	7	94	233	311
	Tows Split	1	6	41	38
	Tow Assists	0	2	20	33
	Prob. of Coll.	0	.0106	0	0
2001–3001	Collisions	0	0	0	0
	Total Passages	5	127	232	109
	Tows Split	0	13	46	18
	Tow Assists	0	9	28	13
	Prob. of Coll.	0	0	0	0
1001–2001	Collisions	0	2	0	1
	Total Passages	101	796	475	281
	Tows Split	2	38	62	38
	Tow Assists	3	50	66	60
	Prob. of Coll.	0	.0025	0	.0036
1–1001	Collisions	1	0	1	0
	Total Passages	832	1015	319	33
	Tows Split	47	58	40	4
	Tow Assists	27	60	41	7
	Prob. of Coll.	.0012	0	.0031	0

FIGURE 5.1A. TOTAL TOW POPULATION MATRIX THRU BERWICK BAY

Probability of a collision (based on accidents during the period)

The matrix data is displayed in bar chart form in Figure 5.1B. Both tow length and horsepower charts are displayed. The majority of the tows (39%) are between 401 and 701 feet long with the second highest category (25%) in the 701 to 1001 foot range.

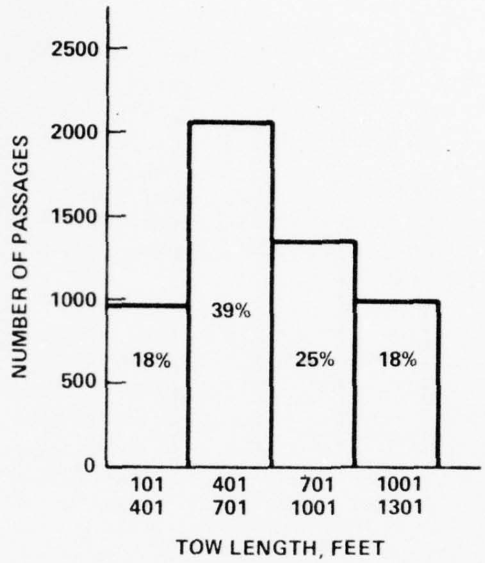
The majority of towboats (41%) have power plants in the 1 - 1001 hp range. Actually there are few power plants below 500 hp so the range is more like 500 to 1000 hp. The second highest horsepower category is the 1001 to 2001 hp representing 31% of the towboats.

Population data is displayed in Figure 5.2. Segments containing the largest number of vessels are enclosed in a heavy line. The three largest segments include lengths of 400' - 700' at 0 - 1000 horsepower containing 1015 passages, the 100' - 400' length at 0 - 1000 horsepower containing 832 passages, and the 400' - 700' length at 1000 - 2000 horsepower containing 796 passages. The remainder of those segments outlined contain more than 100 passages but all are considerably less than the three largest. As might be expected the higher horsepower towboats are not used to push single barges or small numbers of barges as indicated by the relatively few passages in these segments.

The casualty population covering the period FY70-75 has been overlaid on the total population matrix as shown in Figure 5.3. All types of cases are included: loaded, light, mixed, upriver, downriver, etc. Three tows even had the assistance of headboats but still hit the bridges. The major number of casualties occur in the highest populated segments with a cluster of eight cases at a tow length of 800' and horsepower range of 700 to 1000 hp. Those segments which contain two casualties or less account for 1641 safe passages or 31% of the total population. Those segments which contain three casualties or more account for 3718 safe passages or 69% of the total population.

Three horsepower parameters (HP/L) have been plotted on Figure 5.3 for values of 1, 2, and 3. Nineteen of the casualty cases (51%) fall between HP/L values of 1 and 2, five are slightly less than HP/L = 1 and eight fall between HP/L values of 2 and 3, and there are 5 cases slightly greater than HP/L of 3. The HP/L parameter is a reasonably good measure in this location because only single string tows pass thru these bridges.

Assisted passages are shown in bar graph form in Figure 5.4. The diagonally cross hatched section of the bars represent cases where a headboat or a bow thruster were used. The horizontally cross hatched area represents cases where two or more trips were made to pass the tow thru the bridges. The upper portion of the curve represents the total number of passages of tows in the length ranges shown. The shortest length range 101' - 401', has 945 passages and 80 or 8% assists; the largest number of passages, 2073, consists of tows in the 401' - 701' range with 244 assists or 12%; the next length range, 701' - 1001' had 1366 passages and 358 assists or 26%; the last category has 975 cases in the 1001' - 1301' range with 253 assists or



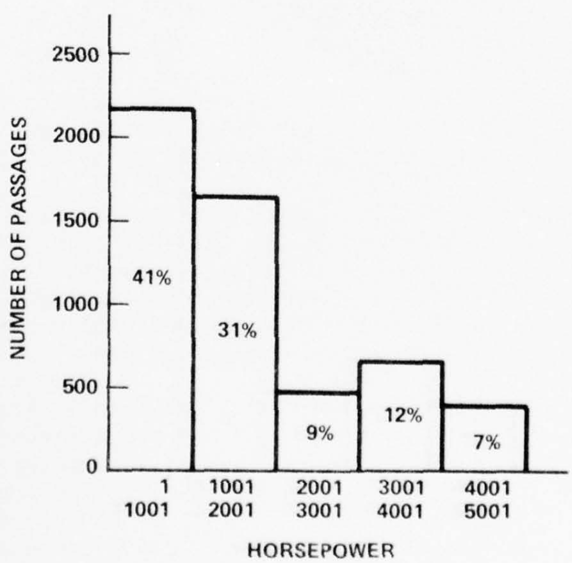
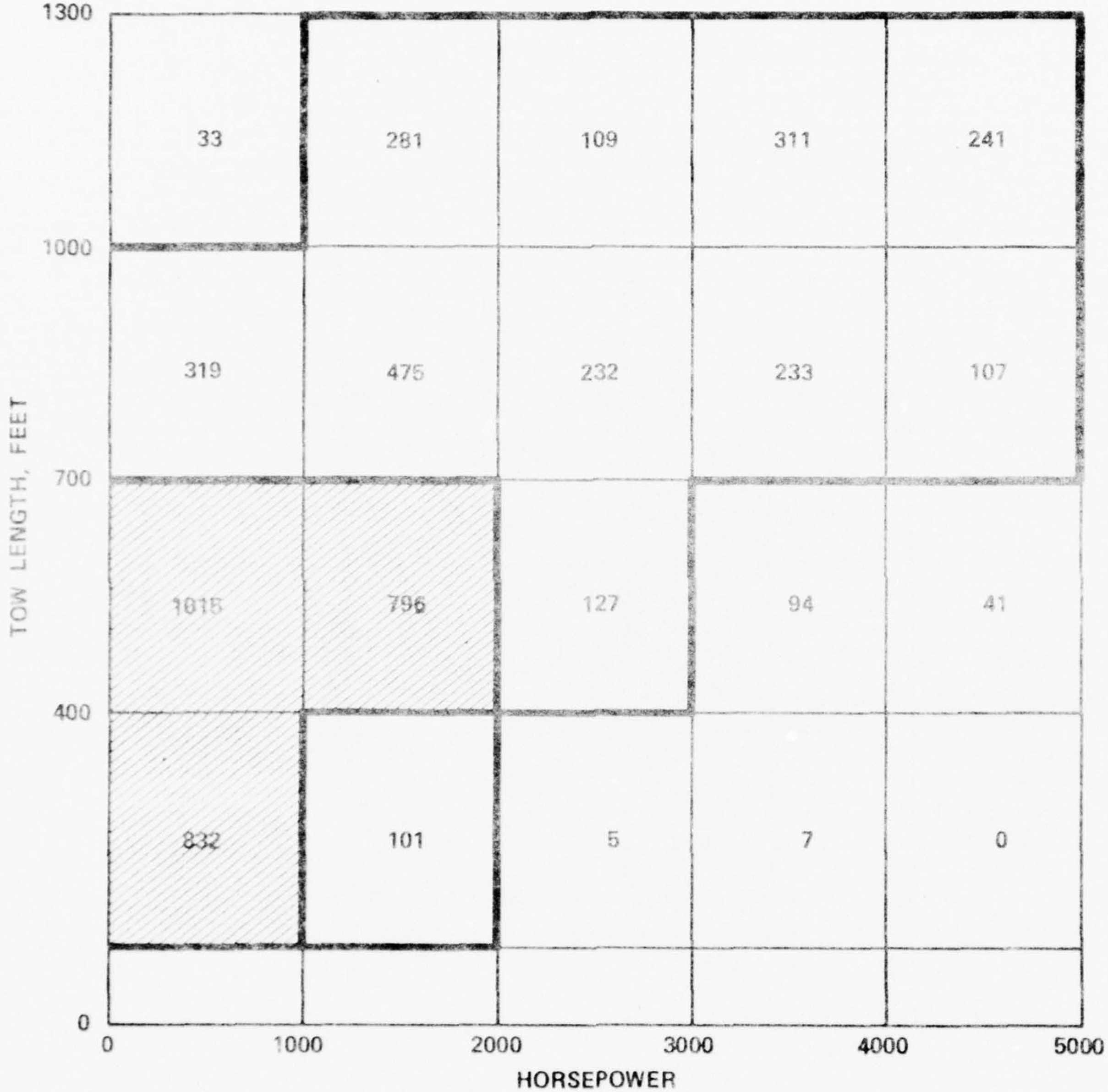


FIGURE 5.1B. TOTAL POPULATION BAR CHART



NUMBERS REPRESENT THE TOTAL NUMBER OF PASSAGES OF TOWS REPRESENTED BY EACH SEGMENT DURING THE PERIOD 2/75–1/76

FIGURE 5.2. TOW POPULATION BY LENGTH AND HORSEPOWER

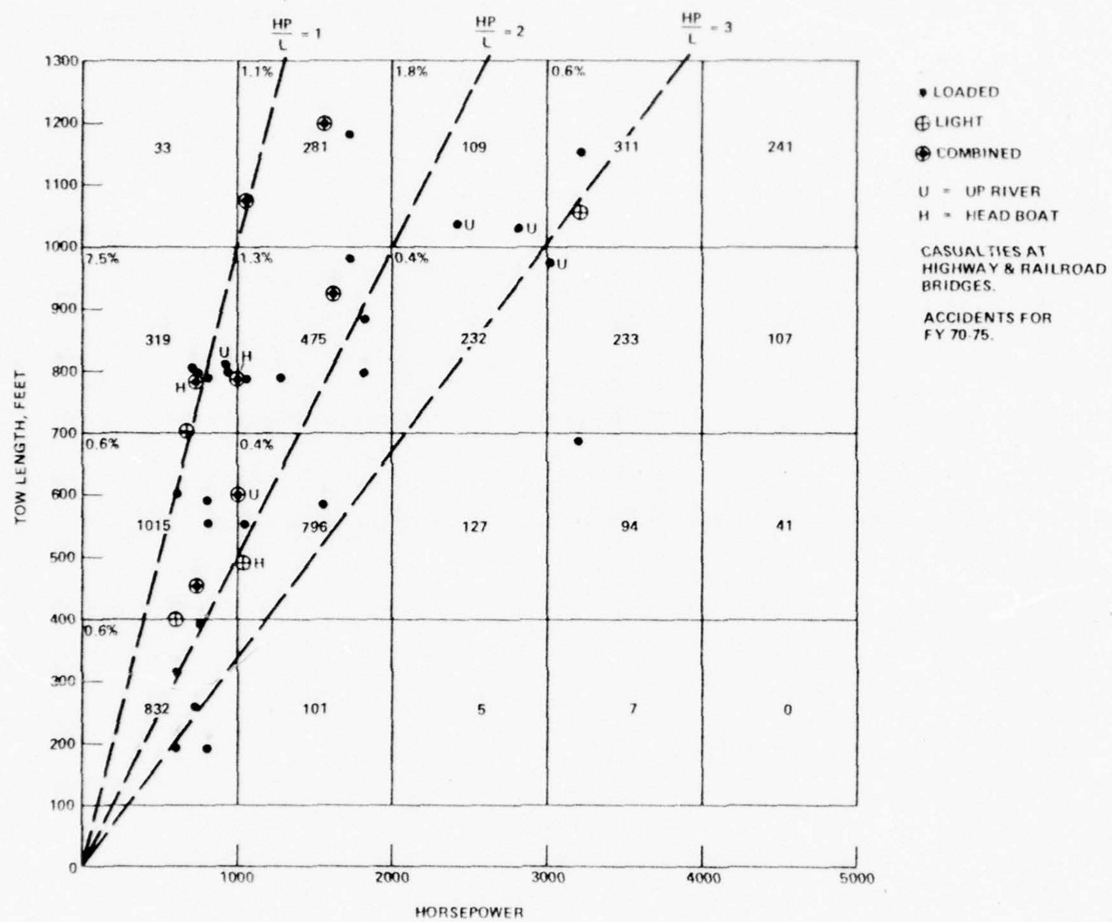


FIGURE 5.3. CASUALTY POPULATION OVERLAY

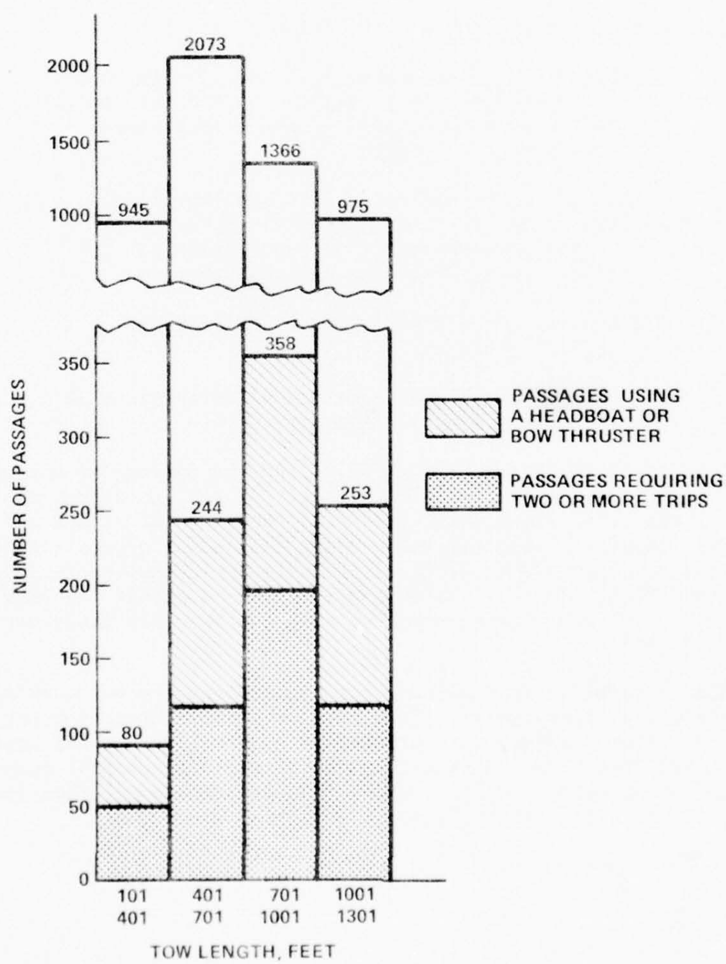


FIGURE 5.4. PASSAGES WHERE ASSISTANCE UTILIZED

or 26% of the total cases in that category. As might be expected the longer tows utilized assistance to a greater degree than the shorter tows.

5.2 ASSESSMENT OF VTS OPERATION

As a result of the high number of yearly bridge collisions at Berwick Bay, the Coast Guard established regulations governing navigation thru this area. The first of these regulations was established on January 15, 1973, during a high water period which lasted until July 19, 1973 when the river flow subsided. A summary of regulations and periods of enforcement is shown in Table 5.1.

In general the restrictions are listed as follows:

Southbound: non-integrated tows are limited to a single barge unless assisted by another towing vessel or a bow steering unit. Integrated tows are unrestricted.

Northbound: non-integrated tows are limited to two barges in tandem unless assisted by another towing vessel or a bow steering unit. Integrated tows are unrestricted.

Hazardous Cargo: towboat horsepower must be 1000 or greater.

These restrictions have been modified slightly since 1973. Copies of each Special Notice can be found in Appendix D.

With the casualty data from FY70-75 and the periods of navigation restriction during 1973, 1974, and 1975, we have the data to assess the effectiveness of these regulations during the first three years of operation. This information is shown in Table 5.2 which lists the number of casualties by month and year. Cross hatched sections indicate periods where the regulations were in effect. There is no evidence in the data that the regulations are effective to any degree when compared with the previous three unregulated years, 1970, 71 and 72.

In an attempt to find out why the regulations are not working the accident data was analyzed again. This time only accidents which occurred during the regulatory periods were plotted in Figure 5.5. It was hoped that some significant feature would be evident which would pinpoint a specific indication of the problem. Unfortunately this accident population looks the same as the 6 year accident population of Figure 5.3.

5.3 REGULATION RECOMMENDATIONS

5.3.1 <u>Data Base</u>

Berwick Bay is unique. It has the worst accident history of all the bridges studied. It has a recent tally of successful passages during a

TABLE 5.1

SUMMARY OF SPECIAL REGULATIONS GOVERNING
NAVIGATION ON BERWICK BAY

15 JAN 1973 - SPECIAL NOTICE 1-73 ISSUED - GOVERNED MOVEMENT OF VESSELS AND COMPOSITION OF TOWS

18 APR 1973 - SPECIAL NOTICE 2-73 ISSUED - CLOSED NAVIGATION IN BERWICK BAY DUE TO HIGH WATER

18 JUN 1973 - SPECIAL NOTICE 2-73 CANCELLED - REOPENED BERWICK BAY TO MARINE TRAFFIC

19 JUL 1973 - SPECIAL NOTICE 1-73 CANCELLED

11 JAN 1974 - SPECIAL NOTICE 1-74 ISSUED - GOVERNED MOVEMENT OF VESSELS AND COMPOSITION OF TOWS

16 FEB 1974 - SPECIAL NOTICE 2-74 ISSUED - ESTABLISHED VTS (TEMPORARY)

15 APR 1974 - SPECIAL NOTICE 2-74 CANCELLED

16 AUG 1974 - SPECIAL NOTICE 5-74 ISSUED - GOVERNED MOVEMENT OF VESSELS AND COMPOSITION OF TOWS (SUPERCEDED SPECIAL NOTICE 1-74)

15 JAN 1975 - SPECIAL NOTICE 1-75 ISSUED - ESTABLISHED VTS (PERMANENT)
LOCAL NOTICE TO MARINERS 1-75 ISSUED - CANCELLED SPECIAL NOTICE 5-74; PLACED HIGH WATER LIMITATIONS OF SPECIAL NOTICE 1-75 IN EFFECT

23 JUL 1975 - LOCAL NOTICE TO MARINERS 2-75 ISSUED-HIGH WATER LIMITATIONS OF SPECIAL NOTICE 1-75 SUSPENDED

20 MAR 1976 - NOTICE TO MARINERS BROADCAST - HIGH WATER LIMITATIONS OF SPECIAL NOTICE 1-75 IN EFFECT

26 APR 1976 - NOTICE TO MARINERS BROADCAST - HIGH WATER LIMITATIONS OF SPECIAL NOTICE 1-75 SUSPENDED

TABLE 5.2

BERWICK BAY ACCIDENT RECORD DURING
REGULATED AND NON-REGULATED YEARS

MONTH		YEAR 1970	1971	1972	1973	1974	1975	1976
JAN	HISTORICAL HIGH WATER PERIOD	2	1	3	1 15 JAN	11 JAN 0	2 15 JAN	
FEB		1	1	0	2	0	0	
MAR		0	3	1	1	1	3	20 MAR
APR		2	0	1	3 18 APR	1 2	0	26 APR
MAY		3	1	1	CLOSED	15 APR	0	
JUN		0	0	0	18 JUN 2	1	0	NO
JUL		0	0	0	1 19 JUL	1	23 JUL	DATA
AUG		0	0	1	0	16 AUG		
SEP		1	0	1	1	0	0	
OCT		0	0	0	0	0	0	
NOV		0	0	2	0	0	0	
DEC		0	1	2	0	1	0	
TOTALS		9	7	12	11	7	5	
PERCENT OF ACCIDENTS DURING HISTORICAL HIGH WATER PERIODS		89%	86%	50%	91%	86%	100%	NO DATA
PERCENT OF ACCIDENTS DURING REGULATED PERIODS		–	–	–	82%	43%	100%	

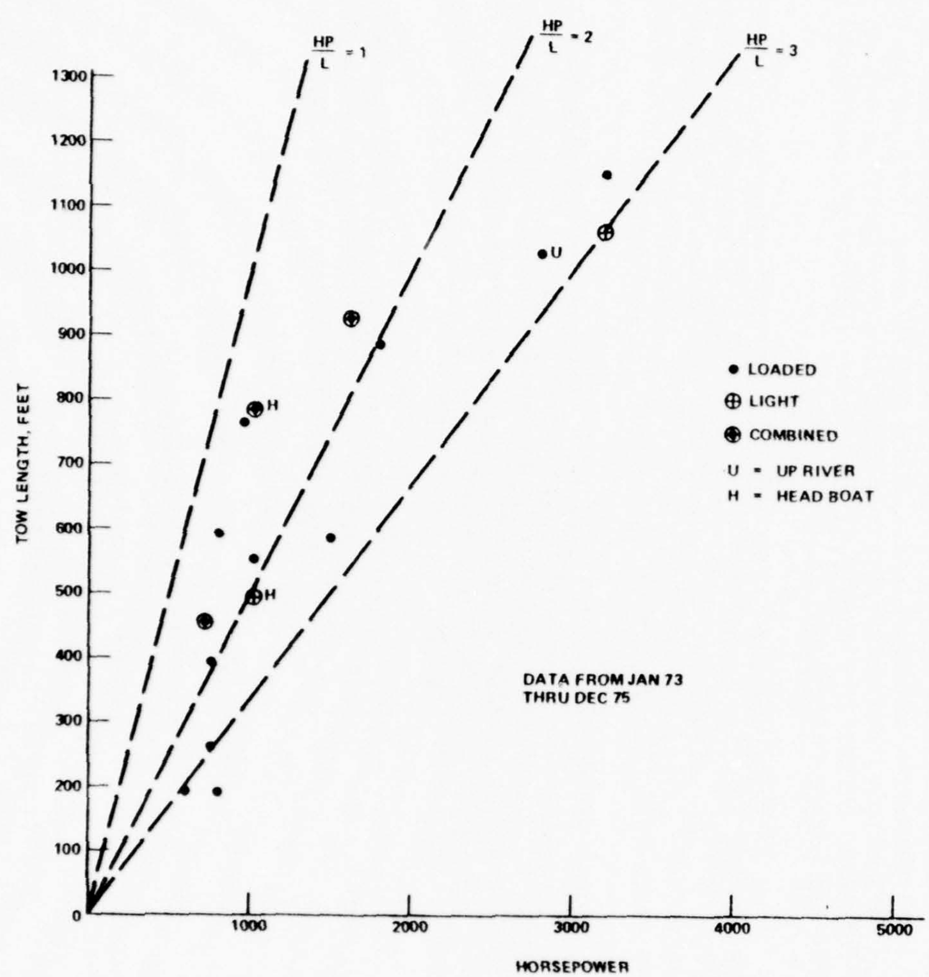


FIGURE 5.5. CASUALTY POPULATION DURING REGULATED PERIODS

12-month period with associated tow characteristics, i.e., length, horsepower, number of barges, etc. It has a recent 3-year history of regulatory restrictions during periods of high water. It has an established VTS system which monitors traffic on a 24-hour basis and which could provide additional future data if required. This unique situation provides the opportunity for development of an improved and effective regulation. An optimum regulation ought to be designed to eliminate a maximum number of casualties with a minimum disruption of the total number of normal passages.

Normal passages for a 12-month period (February 1975 to January 1976) are shown in Figure 5.2. There were approximately 5,359 passages during that period. Figure 5.3 shows six-years worth of casualties superimposed on the normal passage matrix of Figure 5.2. There were 37 casualties during these years. Fortunately, the casualties are grouped in a triangular area in the upper left-hand corner of Figure 5.3, indicating a definite sensitivity or relationship between horsepower and tow length.

Two of these diagonal lines representing HP/L ratios are effective in bounding the casualty population. There are only 5 data points outside the HP/L = 3 line so that 86% of the accident population is represented by tows whose HP/L ratios are less than 3. In fact, 65% of the accident population is represented by tows whose HP/L ratios are less than 2.

Many tows operate normally at HP/L ratios greater than 2 or 3. For example, if the normal passage population were assumed to be equally distributed within each of the matrix rectangles of Figure 5.2, we can estimate that there were 1,835 passages of tows whose HP/L ratio was greater than 3 and 2,758 passages of tows whose HP/L ratio was greater than 2. This amounts to 34% and 51% of total passages respectively.

Thus, the data is available for isolating the casualty population and calculating the effects of any regulatory action on the normal passage population. This will provide a sound basis for the effective regulation of the Berwick Bay area.

5.3.2 Proposed Regulation

The data and data parameters described and developed in the previous section can be used to create a hypothetical regulation which has the potential for theoretically eliminating all accidents related to tow operation in high water and swift currents. The basic principle of this hypothetical regulation is to eliminate all or some fraction of the casualty population from operating through this area during periods of high water. This casualty population is displayed in Figure 5.3, and is so well grouped that HP/L adequately defines the boundary. Fortunately, many of the variables which would tend to cause scatter, i.e., direction of travel, load condition, etc., do not seem to be of overriding importance. The HP/L ratio is an effective measure because of this controlled grouping of data and the fact that only single string tows operate through these bridges so that width is not a factor with 2, 3, and 4 barges abreast.

A very simple and theoretically effective regulation for the Berwick Bay area might be stated as follows:

> "During periods when high water limitations are in effect, only those tows whose HP/L ratio is 3 or greater shall be allowed passage."

This would restrict 86% of the casualty population from operation at this time and still permit 34% of the normal passage population to operate as before. The 66% of the population which will be inconvenienced (including the casualty population) will be forced to "trip" in order to attain a HP/L ratio of 3 or better.

5.3.3 Comparison with Existing Regulations

The present high water regulations at Berwick Bay are a function of the direction traveled, whether the tow is integrated or non-integrated, and whether a headboat or bow steering unit is used.

Non-integrated tows traveling south (with the current) are limited to a single barge regardless of the horsepower. Referring to Figure 5.3 and assuming an average barge is 200 feet in length, history indicates that a 1,000 hp towboat should easily handle a single barge, and a 3,000 hp towboat should have no trouble with 4 barges during these restricted periods. This regulation appears to unnecessarily restrict the higher horsepower tows.

The regulation is overlaid on Figure 5.3 and shown as Figure 5.6A. Note that almost the entire normal passage population is restricted from operation except with a single barge.

Non-integrated tows which are assisted by a headboat or a bow steering unit traveling north or south are not limited in any way. Three recent accidents occurred to tows while operating with headboats which would indicate that their effectiveness is questionable and more study is required.

Non-integrated tows operating northbound (against the current) are restricted to two barges regardless of horsepower. Again referring to Figure 5.3, a 400-foot tow could be handled without mishap by a towboat as small as 1,500 hp and 4 barges could be successfully managed by a 3,000 hp towboat. This regulation also appears to unnecessarily restrict the larger horsepower tows.

The northbound, non-integrated regulation is overlaid on Figure 5.3 and shown in Figure 5.6B. The restricted area contains 82% of the normal passage population including 84% of the casualty population.

The only mention of horsepower in the existing regulation is in the section pertaining to tows with hazardous cargo. In this instance, the horsepower of the towboat must be 1,000 hp or greater. Thus a 1,000 hp towboat with an integrated hazardous cargo tow could legally push 1,000 feet of barges through this area during high water periods. Referring to Figure 5.3, this combination

represents a HP/L ratio of 1, and is a very poor risk when compared to the historical casualty population.

When judging this group of existing regulations against our historical casualty data, several observations can be made:

1. The non-integrated tow regulation is overrestrictive and should have some relationship to horsepower (see Figure 5.6A and 5.6B).

2. Use of headboats and bow steering units requires further investigation before any decision can be made regarding restrictions.

3. The non-regulation of integrated tows lacks any supporting documentation that integrated tows are more controllable than non-integrated tows, especially since 38% of the casualty population were integrated, 50% were non-integrated, and 12% were unknown.

4. The regulation concerning horsepower requirements for hazardous cargo tows without relation to tow length has the potential for catastrophe.

The proposed new regulation is designed to overcome all of the shortcomings of the present regulations. The proposed regulation is shown in Figure 5.6C, and has some of the following advantages:

1. It is less restrictive to the normal passage population of unassisted non-integrated tows.

2. It specifically deals with the area representing the casualty population and does not limit the area of the safe population.

3. It does not discriminate against the larger towboats.

4. It allocates all tows to the historical "SAFE" area including the tows carrying hazardous cargoes.

5. It provides a reasonably defensible position for Coast Guard action.

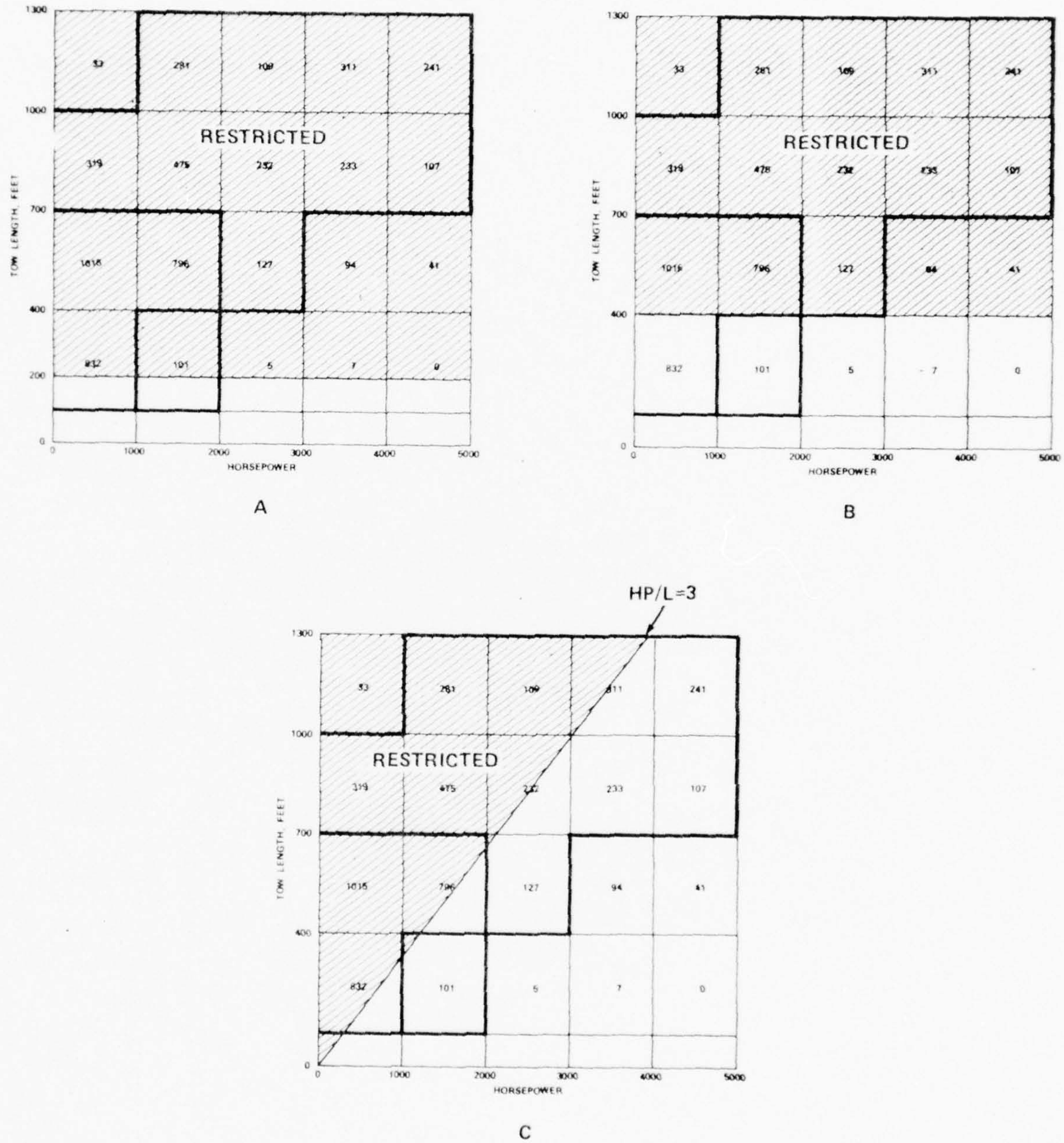


FIGURE 5.6. COMPARISON OF EXISTING AND PROPOSED REGULATIONS

VI. FORT MADISON SUMMARY

6.1 OPERATOR CHARACTERISTICS

Three operators were interviewed regarding the bridge passage at Fort Madison. Their experience as towboat captains ranged from 21 years to 35 years with an equal number of years with the Fort Madison bridge passage. All three worked their way up from deckhand to steersman and finally captain. Two had fathers who were rivermen and as a result became interested in towboats at a very early age. Their present towboat assignments are on vessels of 3200 hp and 4200 hp. Over the past year, two of the operators have operated non-integrated tows of from 12 to 20 barges. The third operates an integrated tow of from 5 to 36 barges. The maximum tow width thru the bridge at Fort Madison is 105 ft (3 barges) because of the narrow bridge span.

6.2 THE BRIDGE PASSAGE

The following is a composite of the navigation and operation of a tow thru the Fort Madison Bridge.

6.2.1 Downstream Operation

Three sailing lines are shown on the chart on the following page (Figure 6.1). Short arrows marked with a "c" designate current direction. Operation is as follows:

- Slow down at 3 and maintain steerage during high water. No need to slow as much during low water.
- Below Dutchman Island line up stern with Dutchman Island light and the bow with the bridge opening. Favor starboard side (sheerfence).

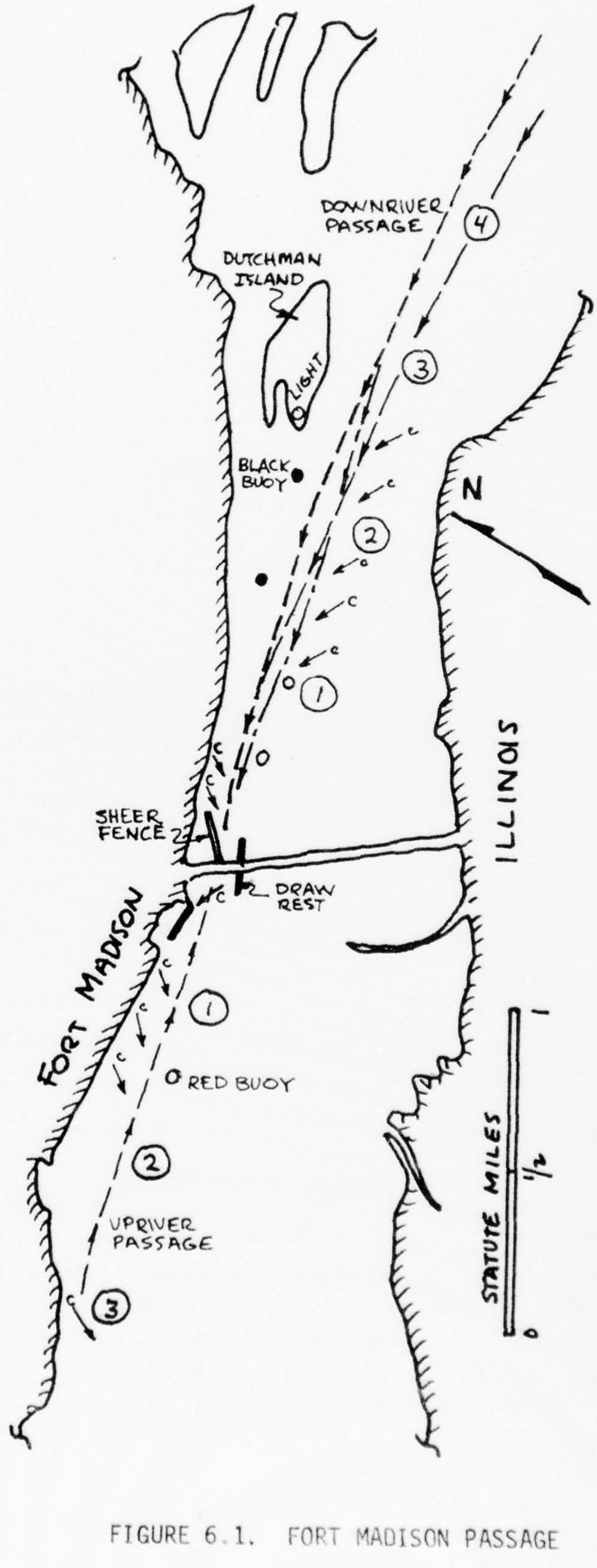


FIGURE 6.1. FORT MADISON PASSAGE

- Hold slow ahead speed until below 1 near sheerfence then go half ahead or full ahead depending on current conditions to counteract current set just above sheerfence.
- In the vicinity of 1 during high water it may be desirable to reverse and flank into position just above the sheerfence. Maintain some headway until close to the bridge then come ahead one half or full and steer toward right hand pier to outrun current which sets tow toward draw rest.
- When head of tow clears right hand pier go hard left rudder to kick stern away from draw rest.
- Just under the bridge expect a strong set to the right thru the bridge.

6.2.2 Upriver Operation

- Come full ahead at 2 to outrun the cross currents. During high water the tow may carry a 20^{o} yaw angle toward the Fort Madison shore to counter the current.
- In the vicinity of the bridge above 1, the draw rest deflects the current below the bridge toward the Fort Madison shore.
- Line up tow on the right side of the draw rest and current will set tow toward left. Adequate speed is required to outrun this current.
- As tow passes under the bridge the current coming off the sheerfence tends to set the tow to the right toward the draw rest.

6.3 NAVIGATION INPUTS USED

- Radio used to contact the bridge and to check for traffic from opposite direction
- Upriver beyond 4 aim tow for hill on Fort Madison side of river just above bridge
- Below Dutchman Island line up stern on light and bow on bridge piers
- Use red and black buoys between 3 and bridge
- Use lights on bridge at night
- Position crewmember on head of tow to communicate position of lead barge during bridge passage.

6.4 SUGGESTIONS FOR A SAFER PASSAGE

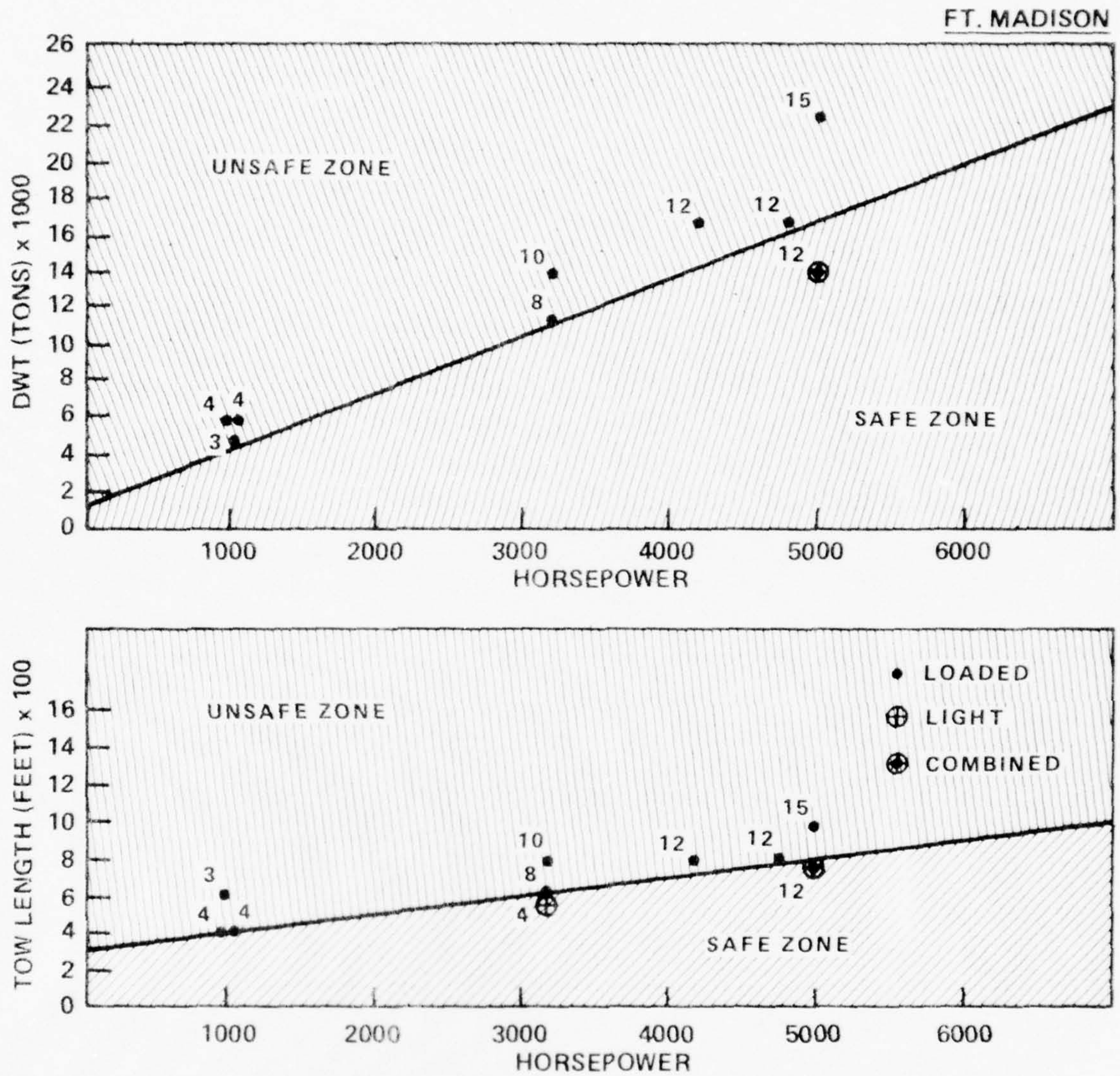
The following are suggestions for Coast Guard consideration. They were solicited during the operator interviews and their feasibility has not been studied.

- River has gradually shoaled outside of channel creating higher current flow in channel. Suggest dredging above bridge to reduce current velocity in channel.
- Construct sheerfence parallel to draw rest
- Construct a dike above and below bridge to straighten out current flow
- The Coast Guard should adopt a more flexible schedule of river maintenance and mark the changes in the river bed as the river stage changes
- Additional navigation aids would be helpful
- Locate a range light below the bridge on the Fort Madison side just below 3 to assist night navigation
- Install a dike above the bridge halfway between 1 and 2.

6.5 GUIDELINE CHARTS

Figure 6.2 shows the accident population at the Fort Madison bridge. Each data point represents a single accident case. Both cargo tonnage (DWT) and horsepower, and tow length and horsepower charts are shown. A third dimension has been added to each data point representing the number of barges in the tow.

All accidents at this bridge are blamed on current conditions so it can be assumed that these charts apply during high water conditions in the river. Operation in the safe areas of the charts during high water should significantly improve the accident record at this bridge. Operators can judge their relative position in the "Safe" - "Unsafe" zones by entering their tow make-up and horsepower values in the charts.



- Data points represent accidents at bridge.
- Numbers next to data points represent numbers of barges in tow.
- All accidents occurred going downstream.
- All accidents blamed on high current.

FIGURE 6.2. FORT MADISON GUIDELINE CHART

VII. VICKSBURG SUMMARY

7.1 OPERATOR CHARACTERISTICS

Three operators were interviewed regarding the passage thru the Vicksburg bridges. Their experience as towboat captains is 6, 15, and 35 years. They all started as deckhands and worked their way up through steersman to captain. The operator with only 6 years experience as a captain started 23 years ago as a deckhand. He is also currently assigned to the largest towboat (10,500 hp). The other two captains are assigned to towboats of 1,800 and 6,800 hp. Over the past year, two of them have operated both integrated and non-integrated tows. The third operates a non-integrated tow. The smaller towboat handles up to 8 barges; the largest towboat handles up to 40 barges pushing 8 wide (280 ft) and 5 long (975 ft). The mid-size towboat handles up to 25 barges, 4 wide upstream, 5 wide downstream, and about 1,100 feet long overall.

7.2 THE BRIDGE PASSAGE

The following is a composite of the navigation and operation of a tow thru the Vicksburg bridges (Figure 7.1).

7.2.1 Downstream Operation

Two downstream sailing lines are shown, one representing the 30 ft river stage and one representing the 10 ft. (normal) river stage. Operation thru this bridge is as follows:

- The 10 ft river stage route marks the downstream passage during normal river conditions.
- Even during normal river conditions current velocity is 4-5 mph.
- Cut speed to half ahead at 5 when loaded and river normal. Cut to float speed if river is high.

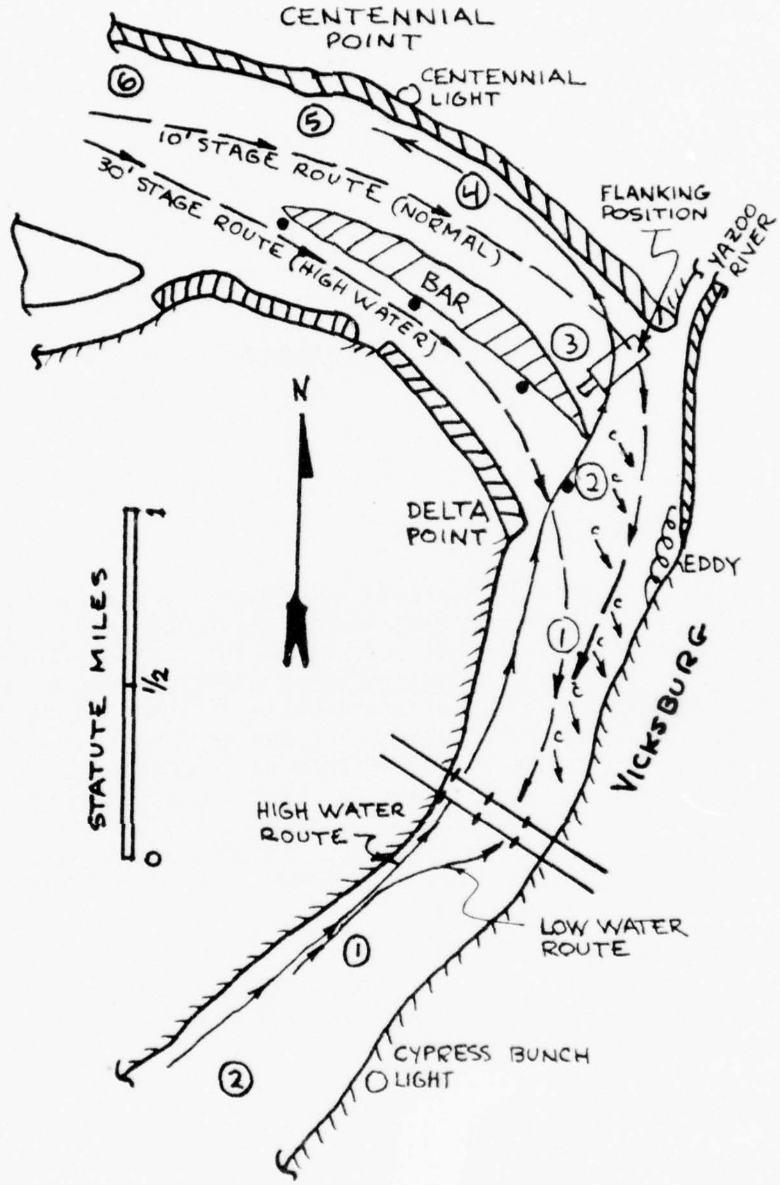


FIGURE 7.1. VICKSBURG PASSAGE

- Aim the head of the tow at the black buoys and let the current take you around the bend at a yaw angle to counteract left hand draft in bend.
- With a loaded tow (25 barges) it may be wise to flank at the mouth of the Yazoo River just below 3 on the chart.
- When flanking at 3 stern is pointed toward Delta Point, bow along the sailing line and tow is floating with speed of current.
- Come out of the flanking position at 2 and drive for the right hand pier of the bridge.
- There is a strong left hand draft in the bend which starts above 1.
- If the choice is to steer around the bend instead of flank cut speed at 5 to half ahead as before and let current carry you around. Judge the drift when between 1 and 2 and then go full ahead for the bridge.
- It is difficult to keep in shape in the bend
- During high water (30 ft stage) and loaded kill headway before reaching 5 and follow the "point way" route close in around Delta Point. Hold on Vicksburg shore when above 2 and line up on right hand pier when in middle of river between 1 and 2.
- If river normal and tow light maintain speed and run down middle of river. There is much more control when light.
- During high water and light, just kill headway at 5 and stay in the middle of the river.
- Use lights on bridge as a range to control slide and rotation.

7.2.2 Upriver Operation

The high and low water routes are shown on the figure.

- Exercise care with a low power tow during upstream operation because current flow and drift just above the bridge at 1 and 2 may set tow back down on bridge during high water.
- Don't cross river at 3 during high water if sufficient horsepower is available to continue around Delta Point.
- After passing thru bridge keep tow aligned with current flow, head into current.

7.3 NAVIGATION INPUTS USED

- When southbound radio used to check for northbound traffic at Kings Point above 6 and at Centennial Light at 5.

- Black buoys that mark bar
- Water tank north of Yazoo River used as visual aid. There is a red light on the tanks at night which is used as a range.
- Cypress Bunch Light used as a range.
- The radar is on at all times - especially at night.
- Bridge lights used as range.

7.4 SUGGESTIONS FOR A SAFER PASSAGE

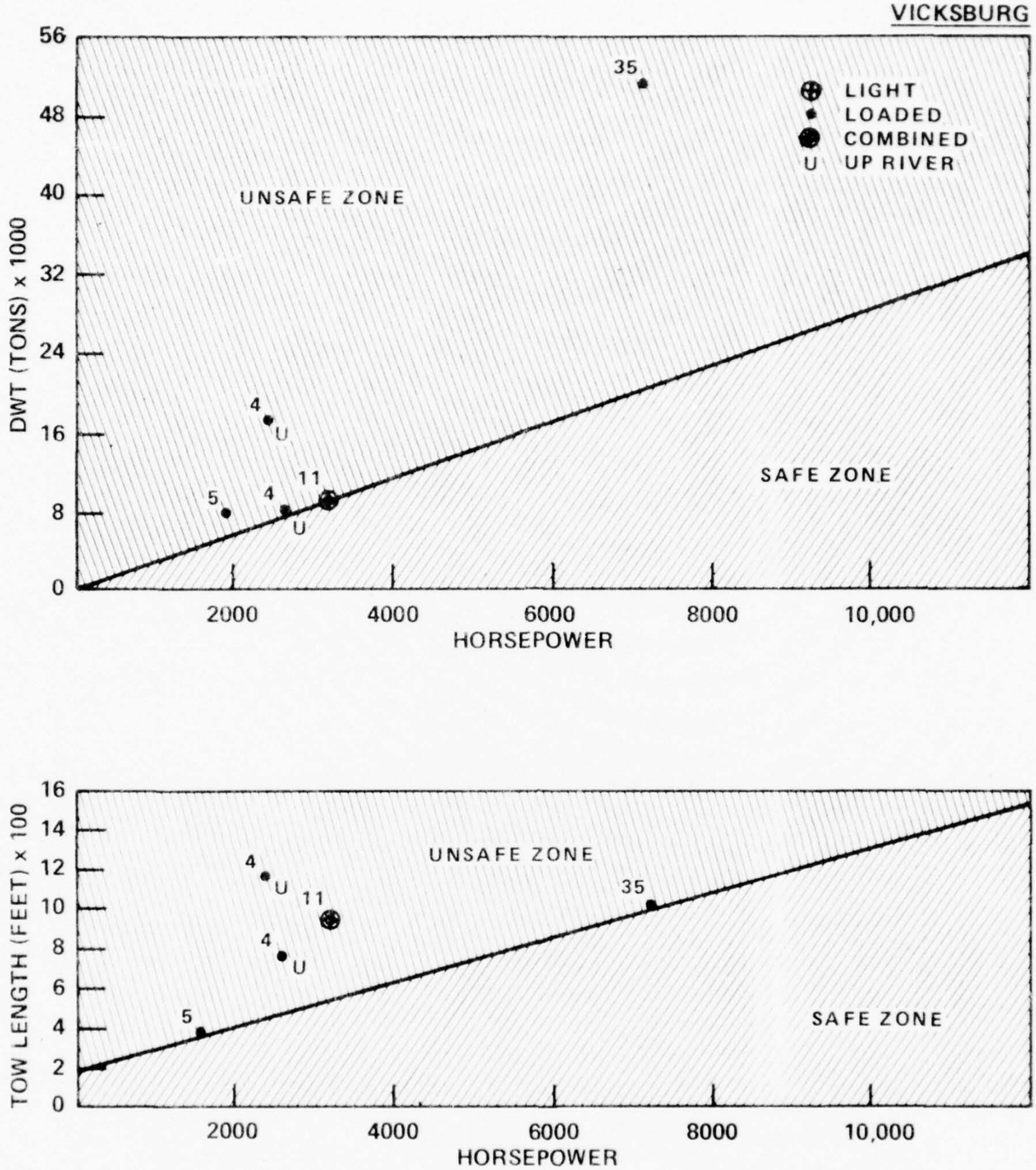
The following are suggestions for Coast Guard consideration. They were solicited during the operator interviews and their feasiblity has not been studied.

- Additional navigation aids in bend.
- Coast Guard should maintain and adjust the position of black buoys as river stage changes.
- The Cypress Bunch Light should be brighter.
- Add retrofeflective material to the bridge piers and install green tape above lights on the navigation span. Towboat crewmen have installed retroreflective tape on Booth Point Bridge, mile 838.7 lower Mississippi River. It is still good after one year and is very satisfactory.
- Navigation lights on bridge should be brighter.

7.5 GUIDELINE CHARTS

Figure 7.2 shows the accident population at the Vicksburg bridge. Each data point represents a single accident case. Both cargo tonnage (DWT) and horsepower, and tow length and horsepower charts are shown. A third dimension has been added to each data point representing the number of barges in the tow.

All accidents at this bridge are blamed on current conditions so it can be assumed that these charts apply during high water conditions in the river. Operation in the safe zones of the charts during high water should significantly improve the accident record at this bridge, although there are not a sufficient number of accident cases at this bridge to define the zones with much certainity. Operators can judge their relative position in the "Safe" - "Unsafe" zones by entering their tow make-up and horsepower valves in the charts.



- Data points represent accidents at bridge.
- Numbers next to data points represent numbers of barges in tow.
- Accidents include both upriver and downriver accidents.
- All accidents blamed on high current.

FIGURE 7.2. VICKSBURG GUIDELINE CHART

VIII. GREENVILLE SUMMARY

8.1 OPERATOR CHARACTERISTICS

Five operators were interviewed regarding the Greenville bridge passage. Four were interviewed by telephone and questionnaires completed. One was interviewed during a trip thru the Greenville bridge at night. A questionnaire was not completed for this operator but much valuable navigation data was documented.

One operator had only 6 years experience as captain, the others had 15, 27 and 34 years experience with a like number of years experience thru the Greenville bridge. All worked their way up from deckhand (one started as a galley boy) to steersman to captain.

Two of the captains are presently assigned to large towboats of 10,500 hp which are triple screw and normally push non-integrated tows of 25-43 loaded barges down stream and 49-54 loaded barges upstream. Maximum loaded tow width is 280' (8 barges) and 975' long (5 barges). The second largest towboat, 3200 hp, pushes an integrated tow with a width of 105' (3 barges) and 975' long (5 barges). Southbound the cargo is grain and the barges are empty northbound. The smallest towboat, 1800 hp, pushes a mixed tow of 8 barges usually loaded upstream and empty downstream.

8.2 THE BRIDGE PASSAGE

The following is a composite of the navigation and operation of a tow thru the Greenville bridge.

8.2.1 Downstream Operation

- Slow loaded tow at location 5 to about ¼ - ½ speed depending on conditions.

- Let current take tow around bend. Keep an easy distance off buoys, for low water passage, and let stern fall to starboard.

- Below 3 align stern with the Vaucluse Light.

- Between 2 and 1 current will set tow toward revetment. Flanking may be required in this area to counteract set of current.

- Between 1 and 2 drive fall ahead for bridge and align with left hand pier.

- Between 1 and the bridge, the tow will encounter a left hand draft and must steer to the right to offset it. This situation was demonstrated by the pilot during the trip thru this bridge. He held 0° rudder and we used the green navigation lights on the upstream and downstream sides of the bridge span as range lights to observe the set to the left toward the left hand pier.

- During high water the high water route shown on the chart is generally followed with some slight deviation depending on conditions.

- Procedure is generally the same for empties except more headway is maintained and the tow may slide on windy days.

8.2.2 Upriver Operation

- From below bridge just come up on green lights at center of span and proceed full ahead during low water.

- Tow steers faster with empties, slower when loaded.

- Favor right ascending shore between 2 and bridge during high water.

8.3 NAVIGATION INPUTS USED

- When proceeding south use radio to call for north-bound traffic at mile 536.5 and mile 534.5 (just above 6).

- Red buoys in bend to judge location in channel.

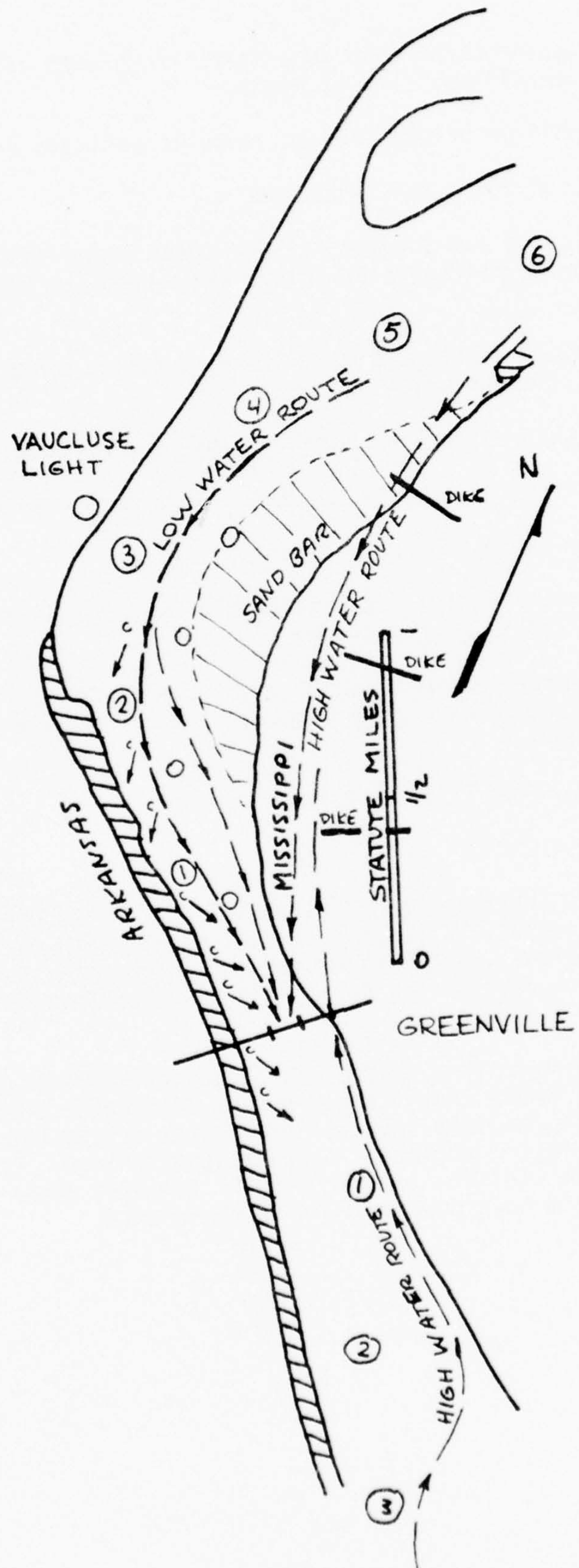


FIGURE 8.1. GREENVILLE PASSAGE

- Vaucluse Light used as a stern range with pilot house window frame at night.

- Lights on bridge used as range to estimate drift.

8.4 SUGGESTIONS FOR A SAFER PASSAGE

The following are suggestions for Coast Guard consideration. They were solicited during the operator interviews and their feasibility has not been studied.

- Replace Vaucluse Light with a stronger green light and flasher below.

- Brighter lights at both Vaucluse and Anconia.

- Service the buoys above the bridge more often.

- Keep sandbar dredged back.

- Retroreflective material should be added next to the lights on the bridge.

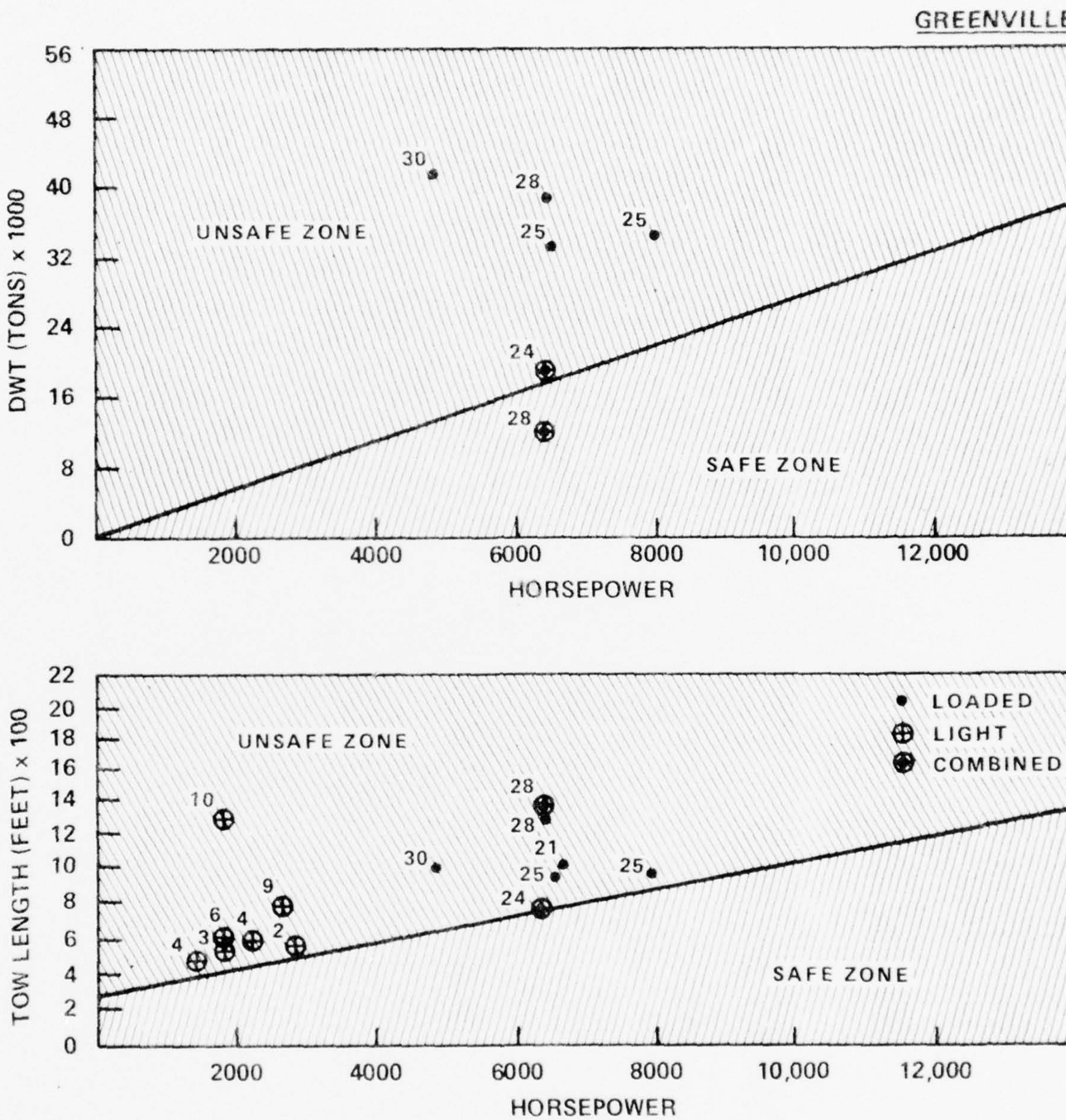
- Retroreflective material on bridge piers, red on left descending and white on right descending piers.

- Need range at Anconia Point.

8.5 GUIDELINE CHARTS

Figure 8.2 shows the accident population at the Greenville bridge. Each data point represents a single accident case. Both cargo tonnage (DWT) and horsepower, and tow length and horsepower charts are shown. A third dimension has been added to each data point representing the number of barges in the tow.

All accidents at this bridge are blamed on current conditions so it can be assumed that these charts apply during high water conditions in the river. Operation in the safe areas of the charts during high water should significantly improve the accident record at this bridge. Operators can judge their relative position in the "Safe" - "Unsafe" zones by entering their tow make-up and horsepower values in the charts.



- Data points represent accidents at the bridge.
- Numbers next to data points represent numbers of barges in tow.
- All accidents occurred going downstream.
- All accidents blamed on high current and wind.

FIGURE 8.2. GREENVILLE GUIDELINE CHART

IX. BERWICK BAY SUMMARY

9.1 OPERATOR CHARACTERISTICS

Nine operators were interviewed regarding the passage thru Berwick Bay. Two of these interviews were conducted during trips, one north and one south, thru the bridges. Pilot house interviews were not successful for completing questionnaires but were most useful in defining navigation routes, current characteristics, shore points, and tow operation.

Three of the operators had over 30 years experience, one had 27 years, three had greater than 10 and one had 8 years experience as captain. All operators had a like number of years experience operating thru the Berwick Bay bridges. Two of the operators became interested in river boats thru relatives already in the profession. All worked their way up from deck or engine positions. All became steersmen and apprenticed under a captain.

Three operators were presently assigned to towboats with power plants in the 4200-4300 hp range. Three others were operators of 3200 hp boats, two at 1800 and the smallest was 1200 hp. We rode the 1200 hp tow downbound thru the bridges. The tow consisted of 6 barges including 4 empties and a bow steering unit. The tow was 82.5' wide and 1170' long. We rode the 4200 hp towboat northbound thru the bridges. The tow consisted of 2 integrated and loaded tank barges 50' wide and 450' long. Both operators were helpful in pointing out the problems of navigation thru this section of waterway and explained the proper tow operation under these conditions.

9.2 THE BRIDGE PASSAGE

The following is a composite of the navigation and operation of a tow thru the Berwick Bay bridges. A chart of this area is shown in Figure 9.1.

9.2.1 Downstream Operation

- Entering Berwick Bay from the Port Allen route hold the sailing line shown and reduce speed to about half ahead.
- Entering Berwick Bay from Stouts Pass cross the river between 5 and 6 and favor left descending shore.
- Generally hold slow speed between 4 and 3 with intermittent use of power to stay on course and close to shore.
- At 3 current will set tow toward right descending shore if out too far in river.
- Cut point at Conrad Shipyard 3 in close to prevent current from catching stern of tow and rotating it out toward mid-river.
- Run between slow and half speed at 3 to maintain steerage and control.
- Should be shaped up by 2. Current tends to get tow out-of-shape between 2 and 3.
- At 1 either drive or hold half speed depending on conditions.
- Enter highway bridge at mid span or just to the right of mid span depending on current conditions.
- Current will shift at highway bridge and operator must expect a strong left hand draft between bridges.
- Favor right descending pier of railroad bridge to offset current and to prepare for sharp right hand bend in river just below bridge.
- Under some conditions with a long tow you must back and flank as soon as you clear the railroad bridge in order to line up for the passage down river.

9.2.2 Upriver

- In general operator can hold middle of river during upstream approach.
- At 2 slow down and line up with railroad bridge.
- Favor Berwick pier (left ascending pier) to offset current just below and between bridges.

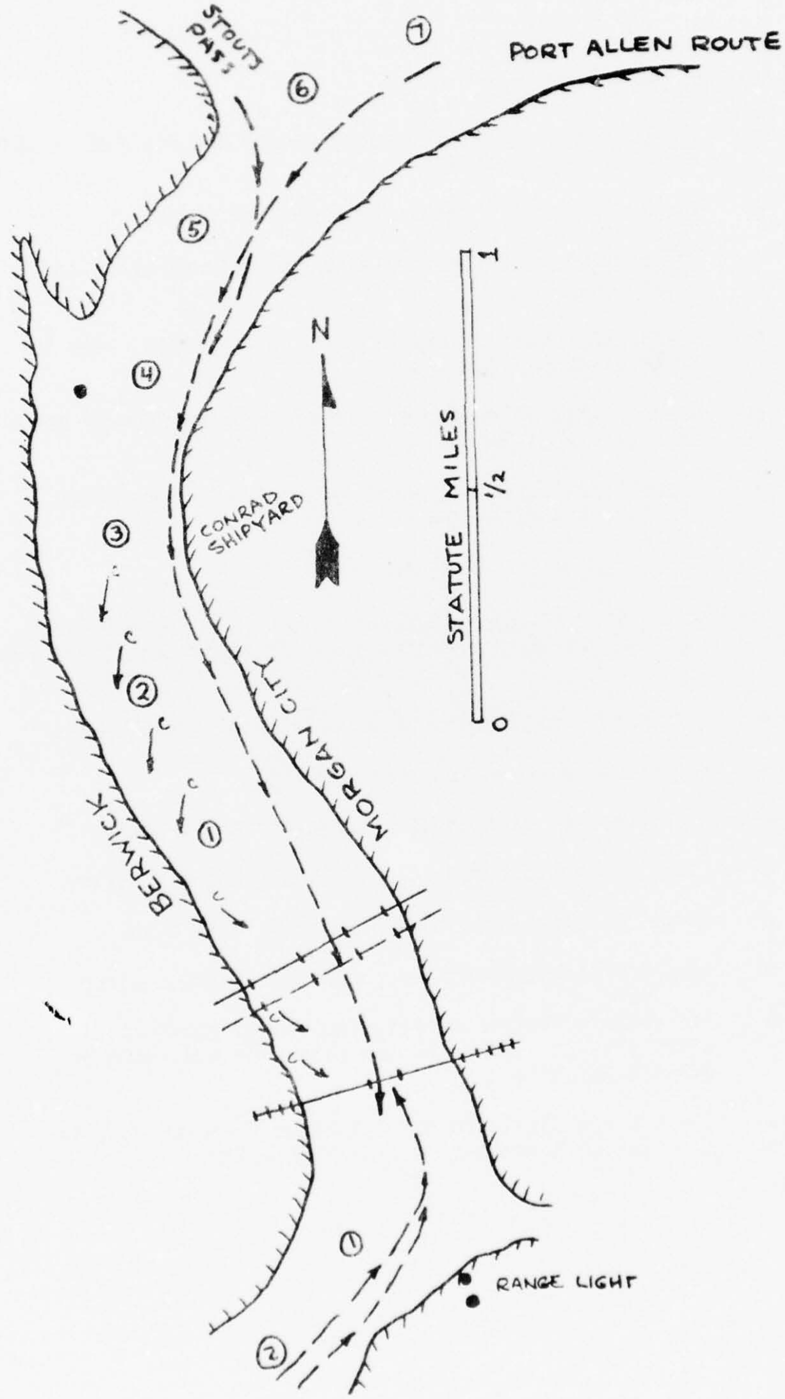


FIGURE 9.1. BERWICK BAY PASSAGE

9.3 NAVIGATION INPUTS USED

- Radio to VTS for clearance at bridge and for information on northbound traffic.
- Radar used at all times especially at night.
- Range light below bridges used to indicate slide and rotation.
- At 2 fishermens' sticks (marking shoal water) used to judge distance from shore.
- Green lights at center of navigation span used as range in vicinity of bridge.
- Eyeball navigation at shore points used in sections without navigation aids.

9.4 SUGGESTIONS FOR A SAFER PASSAGE

The following are suggestions for Coast Guard consideration. They were solicited during the operator interviews and their feasibility has not been studied.

- Add 2 or 3 buoys between 5 and 7 to mark shallow water.
- Provide a safe mooring area above 7.
- Keep buoys on station to prevent grounding tows.
- Establish north range to assist southbound traffic.
- Range below railroad bridge is hard to line up.
- Stop southbound traffic at night during high water.
- Add retroreflective material to bridge piers for night passage, red on Morgan City side and white on Berwick Bay side.
- Coast Guard should restrict tonnage (size of tow) in relation to horsepower during high water.

X. DECATUR SUMMARY

10.1 OPERATOR CHARACTERISTICS

Three operators were interviewed regarding the Decatur bridge passage. One had 35 years experience and is presently assigned to a 3200 hp towboat which handles 12-16 barges. The normal tow width is 105 ft and length is 780 ft. The least experienced operator had been an operator for three years and was master of a 760 hp towboat. The other operator had seven years experience and operates a 1400 hp towboat. All have equivalent years of experience operating thru the Decatur bridges.

Two tows are regularly loaded during the upstream passage and also loaded downstream. The other tow is empty during the upstream passage and loaded or mixed downstream.

Two of the operators started as deckhands and worked their way up to captain. One started out as an engineer. All served apprenticeship as steerman under a captain.

10.2 THE BRIDGE PASSAGE

The following is a composite of the navigation and operation of a tow thru the Decatur Bridges. Figure 10.1 is a chart of this area showing the sailing lines.

10.2.1 Downstream Operation

- Follow the sailing line shown down to 5
- Slow down at 5 and let headway run out
- Maintain speed at about 1/4 to 1/2 ahead depending of current conditions
- At 2 if properly lined up come ahead to 1/2 speed

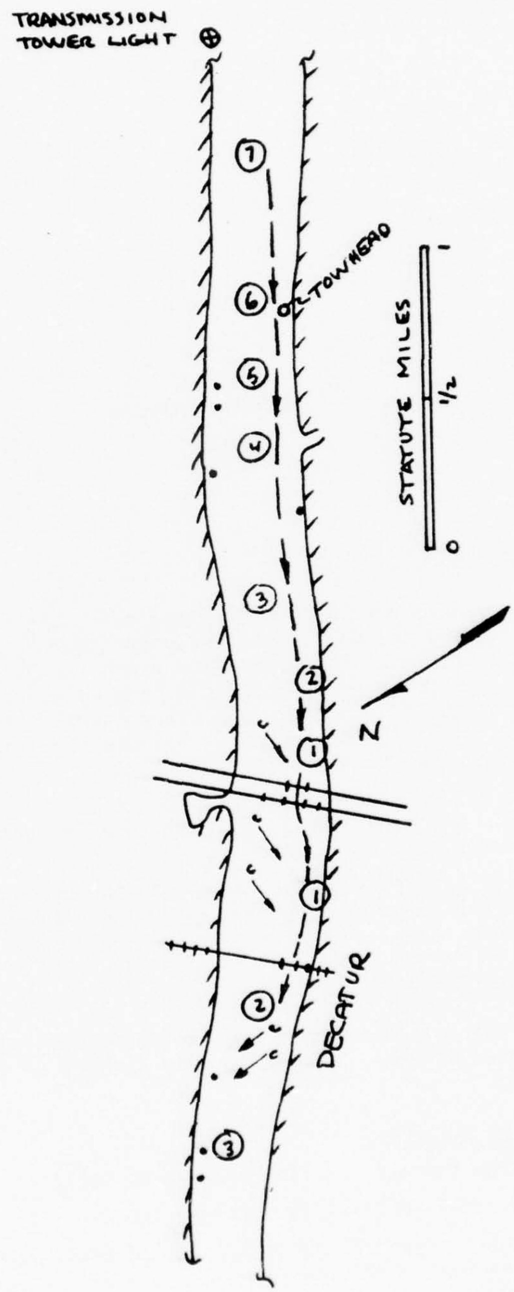


FIGURE 10.1. DECATUR PASSAGE

- When southbound radio used to check for northbound traffic at Kings Point above 6 and at Centennial Light at 5.

- If lined up at 1 come full ahead thru the bridge if conditions warrant. Expect a slight left hand draft at the highway bridge.
- When thru the first bridge reverse and flank toward the left descending shore to line up with the railroad bridge.
- There will be a slight left hand draft between bridges
- Expect a right hand draft below railroad bridge.
- When lined up come ahead full
- During high water it may be necessary to run a little slower.
- During high water at the railroad bridge pass thru the shoreside span.

10.3 NAVIGATION INPUTS USED

- The radio is used to contact the railroad bridge tender.
- The "towhead" between 4 and 7 and the transmission tower above 7 are used as visual aids.
- Radar is used constantly.
- Lights and visual aspects of bridges.
- Local aids to navigation.

10.4 SUGGESTIONS FOR A SAFER PASSAGE

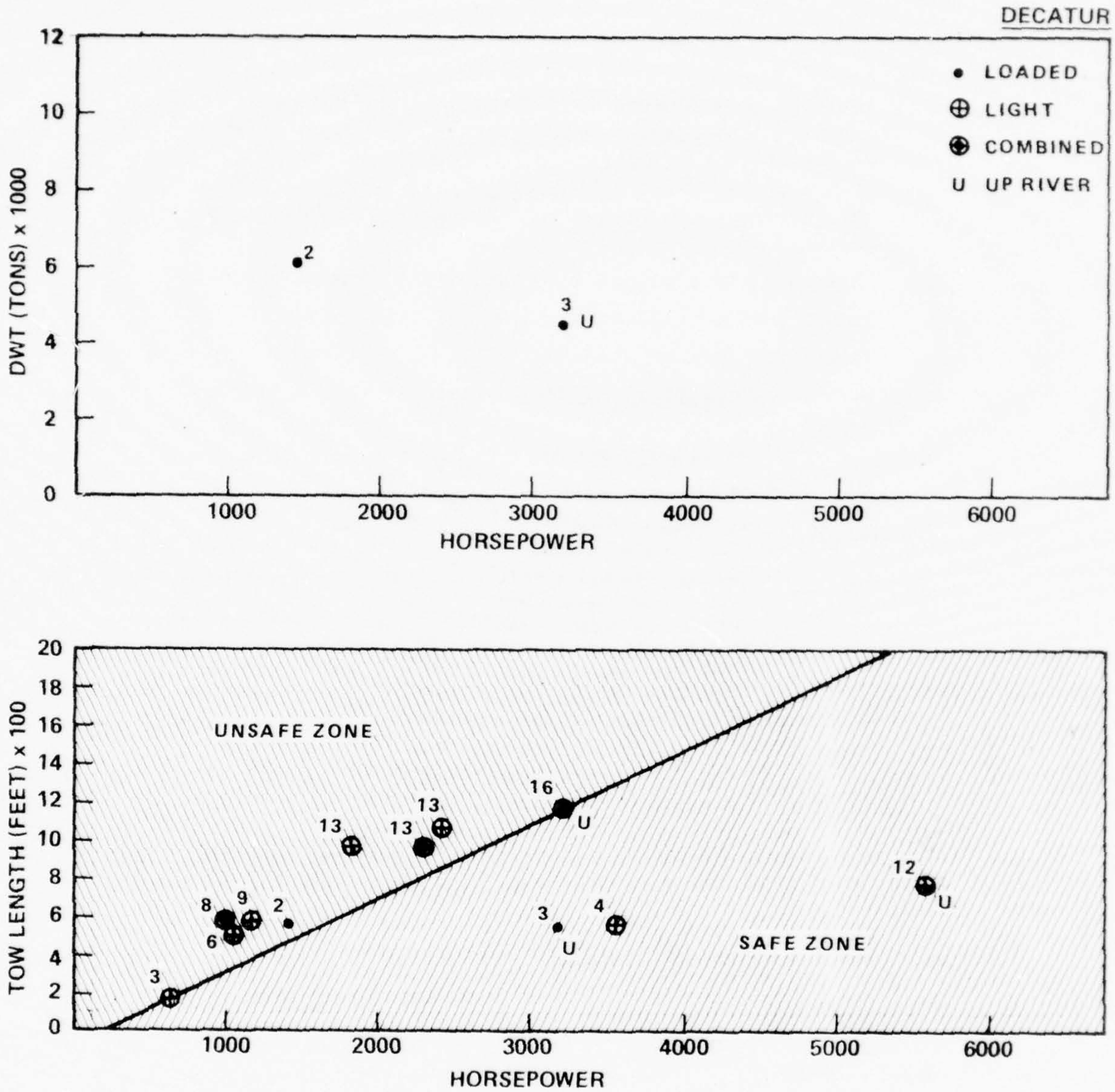
The following are suggestions for Coast Guard consideration. They were solicited during the operator interviews and their feasibility has not been studied.

- Replace railroad bridge with horizontal lift span.
- Better maintenance of lights on bridges, keep them bright and burning.

10.5 GUIDELINE CHARTS

Figure 10.2 shows the accident population at the Decatur bridge. Each data point represents a single accident case. Both cargo tonnage (DWT) and horsepower, and tow length and horsepower charts are shown. A third dimension has been added to each data point representing the number of barges in the tow.

All but three of the accidents at this bridge were blamed on wind and these three were blamed on a combination of wind and current. It can be assumed that these charts apply during extreme conditions of wind and current on the river although there is not sufficient data in the upper chart to establish "Safe" and "Unsafe" zones. Operate only in the "Safe" areas of the lower chart during windy conditions.



- Data points represent accidents at bridge.
- Numbers next to data points represent numbers of barges in tow.
- Eight accidents occurred downriver, 3 upriver.
- Eight accidents blamed on wind, 3 on combined wind and current.

FIGURE 10.2. DECATUR GUIDELINE CHART

XI. CONCLUSIONS AND RECOMMENDATIONS

11.1 THE CONTROL PROBLEM

Ninety-three percent of all of the accidents during the study period (FY70-FY75) are the result of being out-of-shape prior to passing through the bridge. High current conditions were the cause of seventy-three percent of these casualties and twenty percent were the result of high winds. Seventy-four percent of the casualties caused by high river currents happened during the hours of darkness and seventy-two percent of the casualties caused by high winds occurred during daylight hours.

There appears to be a direct correlation between the out-of-shape situation and visibility. Discussions with operators verify that at night it is much more difficult to recognize the onset of a slide or rotation because of the significant reduction in visual aids and impaired depth perception.

Fifty-four percent of the accidents caused by high currents were loaded tows, twenty-seven percent were empty and nineteen percent were partially loaded. Only one of the nineteen accident cases caused by high wind was loaded and the remaining eighteen cases were empty.

Wind forces on the sides of an empty tow will cause it to slide sideways over the water surface and rotate because of the minimal draft of empty barges (1 - 2 feet). This causes the tow to become out-of-shape in a similar manner to the current caused accidents.

Seventy-three percent of accidents happen while operating downstream with the current. The fore and aft axis of the tow is aligned parallel to the current flow lines during most of its trip. At some locations, however, it must operate in crosscurrents and in variable current fields which places the tow at some angle to the flow and creates current forces on the sides of the tow which are small components of the main current field. These transverse current forces increase as the misalignment with the current field increases until at some point the towboat may not have sufficient power to recover.

This situation is indicated by the analytic model results and may help explain why so many tows float down on the bridge broadside to the sailing line.

Summarizing the problem:

- The tow must operate in cross-currents and variable current fields at times causing misalignment;
- During misalignment transverse current forces cause rotations;
- Transverse current forces increase as rotation increases;
- Rotation is difficult to recognize at night;
- It is possible with certain tow, current, and waterway characteristics to reach a rotation angle where recovery is impossible.

Small angles of rotation can be corrected by the operator via the proper application of thrust and rudder angle. The key to this problem is that early corrective action must be applied before the angle gets too great and the transverse forces become dominant. The operator must be alerted to this situation in time to recover. This leads up to a means of indicating the onset of rotation or better yet, the onset and increase in transverse current forces and moments on the tow.

- Operators report that it is most difficult to detect the onset of rotation at night especially in stretches of the river where there are few visual aids, i.e., shore lights, buoys illuminated by the search light, etc. In fact, a single point source such as a visual aid or a group of shore lights are of little help in detection until large angles are reached.

- Another reason for lack of detection of rotation may be a function of the alertness of the operator. This is a possibility, but unconfirmed. His perception of distance, speed, angular, and transverse motion are certainly degraded by darkness but whether darkness also effects his degree of attention or alertness is not known. This would be a suitable subject for the human engineer.

- Operators report using a combination of visual aids to detect rotation (and slide). In most cases various items are combined to act as ranges. For example:

  - Two lights on a water tower.
  - Two lights on the center span of a bridge.
  - The bow of the tow and a distance buoy illuminated by the searchlight.

- The frame of the pilot house window and a single light on shore.
- Actual ranges installed and maintained by the Coast Guard.

Where range combinations don't exist, the searchlights will be constantly used to illuminate the shoreline, buoys, the river surface, eddy currents around the tow, etc.

- A unique navigation system could be designed for the bridge approach which would provide the operator with one or more visual and/or electronic ranges. Many operators now use make-shift ranges consisting of shore and bridge lights at night. An all-weather electronic system might be a modification of the Instrumented Landing System (ILS). This would define the sailing line and indicate both slide and rotation.

11.2 THE SKILL QUESTION

Many of the older operators and all of the management personnel contacted blame accidents on the poorly-trained and unskilled operator. This subject was discussed in Section 3.1, and some observations made concerning the population of operators who have accidents. Some of these observations are:

- 82% of the operators had more than 5 years experience as pilot or captain;
- 54% of the operators had more than 10 years experience as pilot or captain;
- 37% of the operators had more than 15 years experience as pilot or captain;
- Based on the above, one cannot say that our sample of operators lacks in experience.
- This brings up the question of the relationship between skill and experience, and wouldn't the poorly-trained and unskilled operators have been forced out of the pilot house long before obtaining 5, 10, or even 15 years of experience? If the answer is yes, then our operator population consists of those people who have attained a relatively high level of skill such that they are in constant demand by the towing industry (as attested by their long experience). If the answer is no, then we have a situation in which incompetent people can rise to positions of great importance and subsist in these positions for many years. This is not consistent with other private industry, and we doubt that it applies to the towing industry.

Based on the above observations there is little evidence to support the premise that lack of skills is the primary cause of bridge accidents.

11.3 WATERWAY CHARACTERISTICS

Certain bridges have similar waterway approach characteristics which cause trouble for tows of similar characteristics. For example, the Greenville, Vicksburg and Berwick Bay bridges all have sharp bends in the river just above the bridges. Getting out-of-shape in the bend is typical of accidents at these bridges.

Cross-currents in the vicinity of the bridge is also typical of some locations such as Berwick Bay, Fort Madison and Greenville.

Other bridges such as the two at Decatur present unique problems that exist only at that location. The problem at Decatur is one of communication and cooperation with the railroad bridge tender. Tows which must stop between the bridges waiting for the railroad bridge to open are often blown out of control by the wind and do not have sufficient maneuvering room to regain control for making the bridge passage safely.

Thus a solution for a safer passage at one bridge may not apply at others and conversely bridges with similar waterway characteristics may benefit from a single solution.

11.4 OPERATOR SUGGESTIONS

The operators had many suggestions for navigation improvements at each bridge. Suggestions varied from stronger lights on the bridge to changes in the current flow. It was obvious from our discussions that a suggested improvement by one operator would not be useful to another. Before any action is taken on these suggestions it is also obvious that the users should be of one mind. Therefore it would seem reasonable to establish a committee of experts at each bridge to review the suggestions made and to evaluate them in reference to their own experience and come up with recommendations.

11.5 ENGINEERING EVALUATION

In parallel with Section 11.4, it would be advisable to establish a panel of marine engineering experts to assess the tow operation and control problem from an unbiased viewpoint and to design a navigation system for bridges which considers the control capabilities and characteristics of the towboat and tow, the waterway characteristics, the environment extremes, the bridge characteristics, etc. The objective is to study the total system and then define operating procedures and navigation aids which will reduce the hazard and not restrict marine traffic.

11.6 BERWICK BAY

Present vessel movement regulations at Berwick Bay are not effective in reducing the accident rate when compared with prior years and prior environmental conditions. It is recommended that new regulations be instituted

as defined in Section 5.3. It is also recommended that a study be made of the effectiveness of headboats and bow steering units as they apply to operation through this area. It is also recommended that a data gathering program be prepared which will establish a data base for this area and to include the characteristics of current fields in the river, waterway configuration, effects of shoreline structures and activity, tow characteristics, operator characteristics, etc.

These recommendations are made for Berwick Bay because of the Coast Guard installation in this area and the opportunity to gather a complete data base.

APPENDIX A

ANALYTIC MODEL

The analytic model is presented to demonstrate the physical environment which triggers the out-of-shape condition. This is by no means an exhaustive study and contains many simplifications and assumptions due to the lack of supporting data in the literature.

A.1 THE OUT-OF-SHAPE SCENARIO

The tow is proceeding around a bend in a river in a variable current field. In the bend the tow is forced to follow the inside bank and as a consequence becomes misaligned to the current flow lines by some angle θ. This situation is shown in Figure A.1. As the tow becomes misaligned, the stern which is farther out in the river is in a higher velocity current field than the bow, the magnitude of which is a function of θ.

To obtain the net current forces on the tow certain assumptions must be made as follows:

- The current field varies in a constant relationship over the length of the tow.
- The velocity of the center point of the tow is equal to the current velocity at that point, V_c.
- The net current velocity at any point along the tow is $(V_x - V_c)$.
- V_x at distance L/2 from V_c is defined to be $1.5V_c$ to establish the current field as shown on next page.

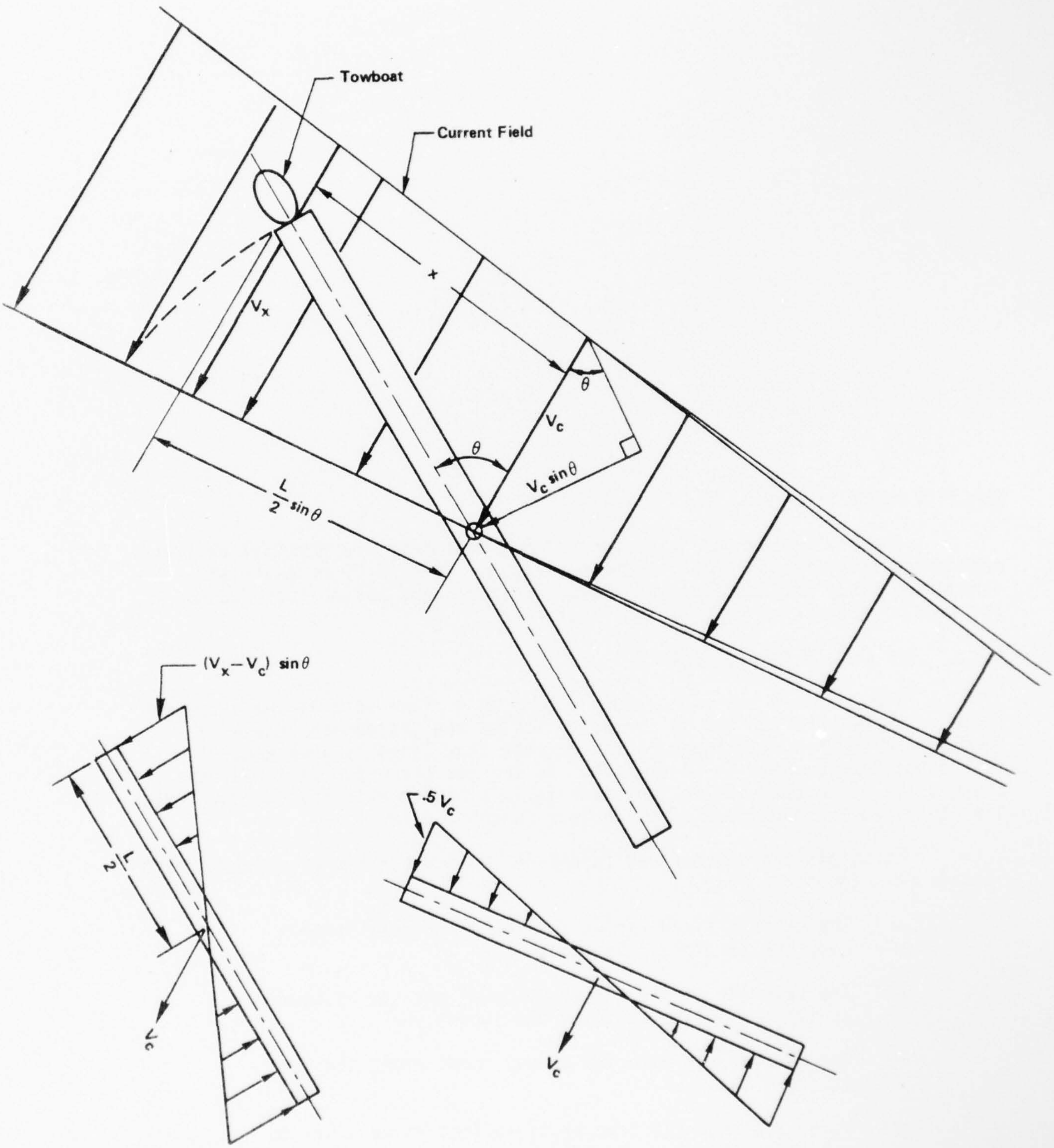
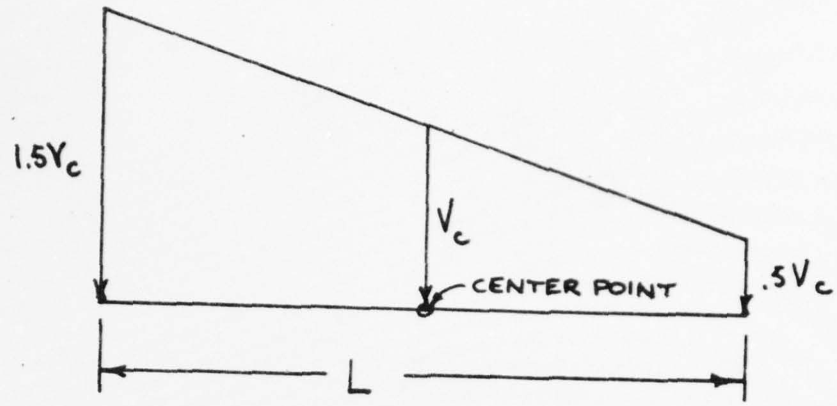
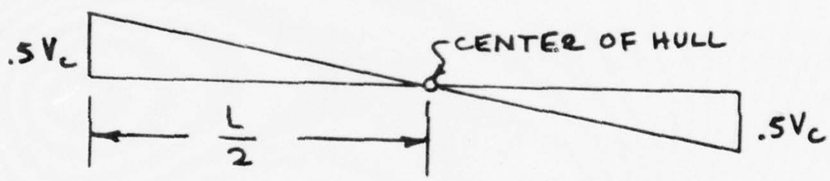


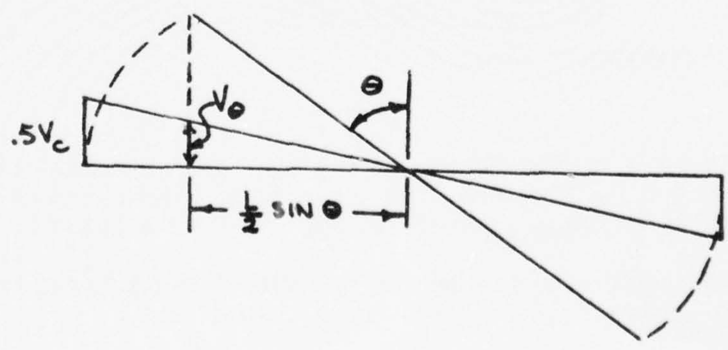
FIGURE A.1. TOW-CURRENT FIELD CONFIGURATION



- The maximum net current velocity perpendicular to the hull is $0.5V_c$ when $\theta = 90^0$.
- The net current distribution on the tow at $\theta = 90^0$ is as follows:

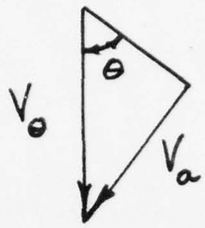


- For angles of θ less than 90^0 the maximum value has the following relationship:



$$V_\theta = .5V_c \sin\theta$$

- The maximum value V_a which is perpendicular to the hull is:



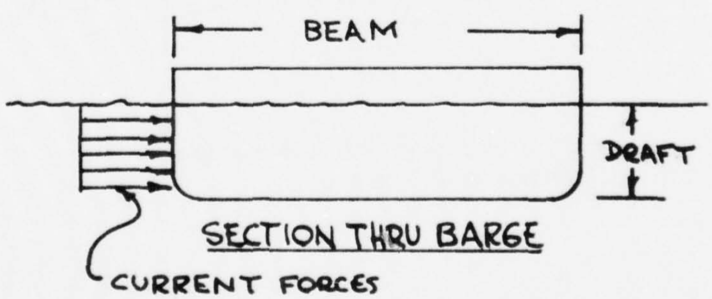
$$V_a = V_\theta \sin\theta$$
$$V_a = .5V_c(\sin\theta)^2$$

A.2 UPSETTING FORCES AND MOMENTS

Representative dimensions for our tow are as follows:

Length, L = 500' including towboat
Beam, B = 35' single barge width
Draft, H = 9' loaded condition

The net current flow is transverse as shown below and the current pressure is against the side of the hull.



The drag of blunt bodies (barges) is higher than pure friction drag would indicate due to eddy-making and flow separation. Hoerner[2] gives a curve of barge forms as functions of drag coefficients and Froude Number.

A representative Froude Number for our situation is transverse current flow of about 5 knots (8.44'/sec) and a beam of 35'.

$$F = \frac{u}{\sqrt{gL}} = \frac{8.44}{\sqrt{32.2 \times 35}} = 0.25$$

[2] Ibid.

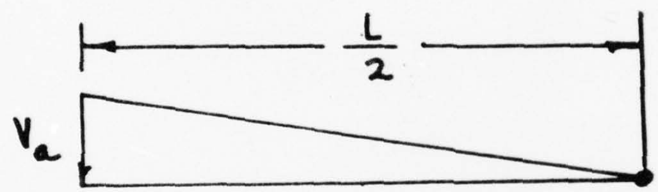
The corresponding drag coefficient, C_D is approximately 1.0.

Total resistance, R_T, is given by the following expression:

$$R_T = C_D \frac{\rho}{2} A\, v^2$$

where:
- $C_D = 1.0$
- $\rho/2 = 1$
- A = frontal area, LxH
- v = average net current velocity against hull

Assuming a triangular transverse current pattern, v is calculated as follows:



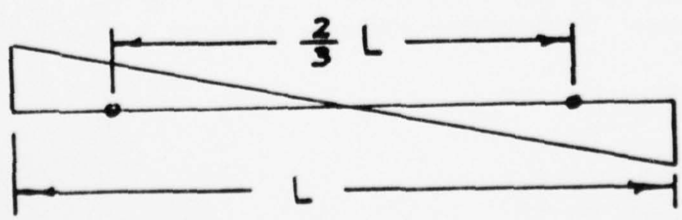
$$V_a = \frac{V_c}{2} (\sin\theta)^2$$

$$v = \frac{V_a}{2} = \frac{V_c}{4} (\sin\theta)^2$$

Total resistance R_T, is then:

$$R_T = C_D \frac{\rho}{2} A \left[\frac{V_c}{4} (\sin\theta)^2\right]^2$$

The center of pressure for the triangular current distribution is:



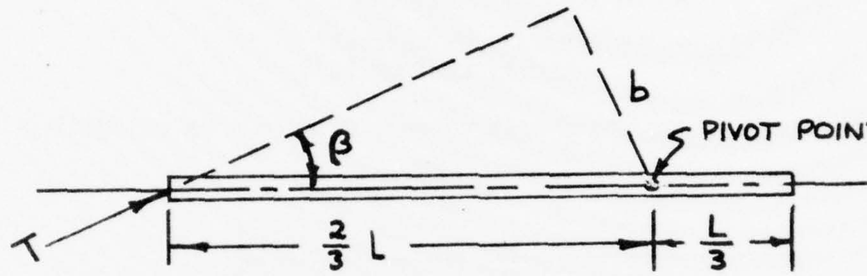
The moment arm is $\frac{2}{3}$ L.

The upsetting Movement $M_u = \frac{2}{3} R_T L$ and

$$M_u = \frac{2}{3} C_D \frac{\rho}{2} AL \left[\frac{V_c}{4} (\sin\theta)^2 \right]^2$$

A.3 RESTORING FORCES AND MOMENTS

The towboat propulsion plant provides the single restoring force, propeller thrust T. Thrust direction is a function of the thrust angle, β, as shown below:



Thrust moment arm is:

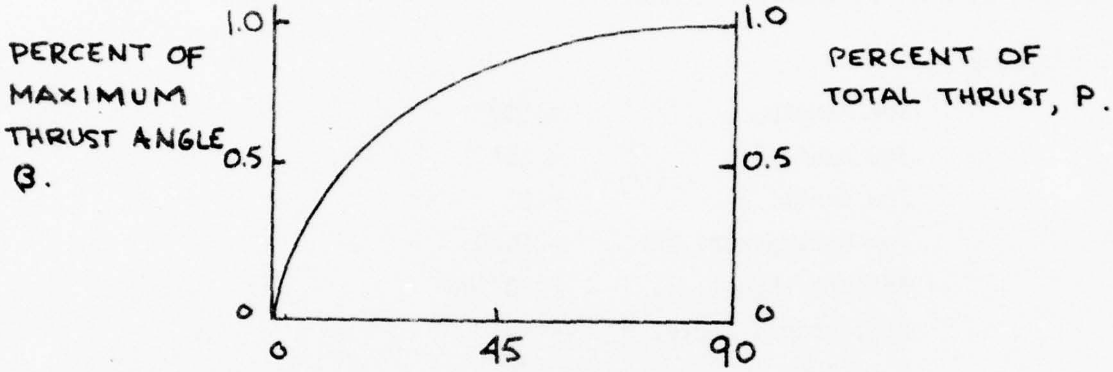
$$b = \frac{2}{3} L\sin\beta$$

Restoring moment M_R is:

$$M_R = \frac{2}{3} TL\sin\beta$$

The problem now is how to define T and β. Each is subject to the control of the operator and the magnitude of each will depend on the operator response to the upsetting moment. For demonstration purposes one must define the operator's response to the following scenario.

Initially the tow is proceeding with the current around a bend in the river. Tow thrust is a small percent of total power to maintain a speed slightly faster than the current. A small thrust angle is carried to keep the tow in line with current flow lines ($\theta = 0$). Deep into the bend the tow must favor the inside bank and θ starts to increase. As the tow rotates due to the upsetting moment the operator responds as shown in the following relationship:



The operator response curve yields the following:

$$P = \sin\theta$$

$$\beta = \sin\theta$$

Total thrust is related by the following:

$$T = PT_B HP$$

where: P = percent of total thrust applied by operator

T_B = bollard thrust or maximum thrust capability at zero speed

HP = available horsepower

Thrust angle is related by the following:

$$\beta = \beta_m \sin\theta$$

where: β_m = maximum thrust angle

Substituting into M_R yields:

$$M_R = \frac{2}{3} T_B HPL\sin\theta\sin\left(\beta_m \sin\theta\right)$$

A.4 SAMPLE PROBLEM

The following input data has been selected as being typical of the casualty population at Berwick Bay. The Bollard thrust value is typical of icebreaker thrust capabilities and due to similarities in operational

requirements of icebreakers and towboats (high thrust at low speeds) this same value will be used for towboats.

Input Data:

Tow length, L	= 500'
Tow beam, B	= 35'
Tow draft, H	= 9'
Tow horsepower, HP	= 1000
Bollard thrust, T_B	= $20^{\#}$/HP
Max. thrust angle, β_m	= 40^{o}

$C_D = 1.0$

$\rho/2 = 1.0$

$A = LxH = 500x9$

Current Velocity, V_C = 4, 6, 8, 10, 12 knots

The upsetting moment M_u, equals:

$$M_u = \frac{2}{3} C_D \frac{\rho}{2} A \frac{L}{16} \left[V_C(\sin\theta)^2\right]^2$$

$$= \frac{2}{3} \times 1.0 \times L \times 500 \times 9 \times 500 \left[V_C(\sin\theta)^2\right]^2$$

$$M_u = 93750 \left[V_C(\sin\theta)^2\right]^2$$

Values of M_u for various velocities are shown in Table A-1.

Restoring moment, M_R, equals:

$$M_R = \frac{2}{3} T_B HPL\sin\theta\sin(\beta_m\sin\theta)$$

$$= \frac{2}{3} \times 20 \times 1000 \times 500 \times \sin\theta\sin(40\sin\theta)$$

$$M_R = 6.66 \times 10^6\sin\theta\sin(40\sin\theta)$$

Values of M_R for various angles of θ are shown in the table on the next page.

TABLE A-1

VALUES OF UPSETTING MOMENT

θ	$\sin\theta$	$(\sin\theta)^2$	4 KTS $\left[V_C(\sin\theta)^2\right]^2$	M_u	8 KTS $\left[V_C(\sin\theta)^2\right]^2$	M_u	12 KTS $\left[V_C(\sin\theta)^2\right]^2$	M_u
0	0	0	0	0	0	0	0	0
30	.500	.25	1	$.09\times10^6$	4	$.38\times10^6$	9	$.84\times10^6$
60	.866	.75	9	$.84\times10^6$	36	3.38×10^6	81	7.59×10^6
90	1.00	1.00	16	1.50×10^6	64	6.00×10^6	144	13.50×10^6

θ	$\sin\theta$	$\sin(40\sin\theta)$	M_R
0	0	0	0
30	.500	.34	$1.13\text{x}10^6$
60	.866	.57	$3.29\text{x}10^6$
90	.100	.64	$4.27\text{x}10^6$

Curves of this data and results are displayed in Section 4.

APPENDIX B

RESULTS OF LITERATURE SEARCH

A literature search was conducted on the navigation procedures utilized by pilots to assure safe passage through dangerous stretches of the Western Rivers. Although little information on this specific topic, was found, a great deal of information was unearthed about relevant background data. This information was organized under the following general topics, for convenience:

- Accident/Safety
- Performance/Advanced Systems
- Analysis/Design
- Transportation/Commerce
- General Background Data.

Title: "Analysis of Bridge Collision Incidents"

Source: Robert B. Dayton
Operations Research, Inc. (ORI)
February 1976

Relevant Information:

This study was devoted to a review of accidents over a five year period (FY70 thru 74), a documentation of casualties at certain bridges and an analysis of casualty data. Hazardous bridges were selected by the Coast Guard for study based on the number of accidents at each bridge during the review period and the background information in Coast Guard files.

Title: "Analysis of Ramming and Grounding Accidents Not Involving Bridges"

Source: J.V. Baum, et al
Battelle Columbus Laboratories

Relevant Information:

This report presented the results and recommendations of an analysis of ramming and grounding accidents not involving bridges for commercial vessels. The results of this study include an analysis of accident causes plus hypothetical personnel actions and material variants that probably would have prevented the casualties. Recommendations were presented on actions that could be taken by the U.S. Coast Guard to reduce the number and/or severity of the accidents and potential improvements in the casualty inspection and reporting system.

Title: "Study of Towing Vessel Safety and Accident Prevention Recommendations"

Source: U.S. National Transportation Safety Board

Relevant Information:

This report described an analysis of towing casualty statistics. Although the amount of data reporting each accident was inconsistent, some observations were made. Recommendations were made concerning the mandatory licensing of the operators of certain towing vessels. In addition, a suggestion was made for further study of the need for such operational control systems on

the congested parts of the inland waterways as speed limits, restrictions on size of tow configurations, and traffic control systems.

Title: "Study of Maritime Aids to Navigation in the Short Distance Maritime Environment"

Source: U.S. Coast Guard
1968

Relevant Information:

The objectives of the study were to determine the current status of the available aids, to describe their operational characteristics, and to develop a methodology for determining the effectiveness of navigational aid system.

Title: "Design and Performance of Bow Structures"

Source: John L. Beveridge
Marine Technology
October 1972

Relevant Information:

This paper concerned the hydrodynamic forces and moments produced by a bow thruster. Several broad problem areas were discussed, and the extent of present-day knowledge was indicated. These problem areas include general duct arrangement, duct shape, and impeller design. A step-by-step design procedure that permits the selection of a practical bow thruster was outlined. This procedure was described for a minimum number of operational requirements, e.g., single bow thruster, a specified turning rate when the ship is dead in the water, and a duty cycle that requires thruster operation at ahead speed for control capability in canals, harbors, and other restricted waterways.

Title: "Puget Sound Tug has Hydraulic Side Thruster"

Source: Marine Engineering Log
January 1973

Relevant Information:

This article highlighted the improved operating efficiency of a tug with a hydraulic side thruster. The side thruster provides improved control for maneuvering in close quarters and breasting barges against piers.

Title: "Assessment of Tug Performance"

Source: W. Baer
J.M. Voith GmbH

Relevant Information:

There are a number of ways in which the power of a tug's engine may be applied, the only criterion being that it should be as effective as possible in all directions. This paper was an attempt to find a basis which facilitates the assessment of a tug's ability to transmit force for ship handling.

Title: "A New Dimension in River Towboats - 10,500 HP"

Source: Cornelius van Mook and Donald P. Courtsal
Marine Technology
April 1975

Relevant Information:

The 10,500 HP towboat has approximately 50% greater horsepower than boats only a few years its senior. This paper described how many of the design parameters were extrapolated, and what other factors were considered in the design of this towboat.

Title: "An Exceptional Towboat Designed For Reliable Services"

Source: Marine Engineering Log
November 1973

Relevant Information:

This article described the technical and operational characteristics of a triple-screw, 7500 HP towboat with a Hydrodyne hull design.

Title: "Pilot Controlled Tugs"

Source: Robert M. Keenholts
Puget Sound Tug and Barge Company
February 1969

Relevant Information:

A Pilot Controlled Tug (PCT) is a vessel that is appropriately equipped for unmanned engine room operations. Several PCT's are being operated along the Pacific Coast and in Alaskan waters. This paper traced the actual development, design, installation and automatic equipment installed in several sea-going tugs.

Title: "Present Day Towboat Monitoring Systems"

Source: B.F. Tracy, Jr.
Ashland Oil and Refining Company

Relevant Information:

This paper gave a brief description of the monitoring and automatic "kick-in" of redundant systems on board towboats. Pilot house operations, engine room controls, and the various alarm systems were mentioned.

AD-A036 732 OPERATIONS RESEARCH INC SILVER SPRING MD F/G 13/13
ANALYSIS OF BRIDGE COLLISION INCIDENTS. VOLUME II.(U)
DEC 76 R B DAYTON DOT-CG-31446-A
UNCLASSIFIED ORI-TR-1016-VOL-2 USCG-D-118-76 NL

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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Title: "Stability of Offshore Tugboats"

Source: Richard Lee Storch
Marine Technology
October 1972

Relevant Information:

A review of available stability criteria, tugboat casualty data, and existing U.S. tugboat design was made to recommend stability criteria for use in the design of offshore tugboats. Casualty data for all tugboat/towboat operations were presented, with breakdowns of offshore casualties and intact stability casualities. A discussion of the mechanisms of intact stability casualties is included. Fourteen existing tugboat designs were listed and compared according to design and stability characteristics. Specific recommendations are then made concerning design features to limit the occurrence of stability casualties and stability criteria to be used for future designs.

Title: "The Dynamic Stability of Towed Ships"

Source: Adolph Strandhagen et al
1950

Relevant Information:

This paper applied mathematical techniques to a study of the dynamic and directional stability of towed ships. It discussed the various factors that affect stability, and the hydrodynamic properties needed for good towing characteristics.

Title: "Slamming Pressures on a Barge Model"

Source: R.T. Huang and O.J. Skeel
October 1971

Relevant Information:

The purpose of this study was to determine if impact pressures generated on barge tows, while operating in waves, could be estimated in the conventional manner for typical ship fore-body forms. It was initiated due to increased offshore barge transportation service and the increasing cost of repairing structural damage caused by barge slamming in rough seas. The

results of this test proved to be consistent with conventional data for slamming of typical ship fore-body forms.

Title: "Resistance of Barge Tows - Model and Prototype Investigations"

Source: U.S. Army Corps of Engineers
August 1960

Relevant Information:

The purpose of this study was to investigate channel effects on the resistance of barge tows. Model tests, consisting of several barges of varying dimensions, were tested in different channel configurations. Comparison of model and prototype data led to the development of an equation for the evaluation of flotilla performance in deep water.

Title: "Analytical Assessment of Barge Train Motions and Sea Loads"

Source: Donald L. Brown
1973

Relevant Information:

This paper discussed a computer program that extended the hydrodynamic ship theory to an elastically coupled dynamic system. Therefore, an analytical tool is applicable for evaluation of proposed barge-coupling concepts.

Title: "Model Tests of a Fully Integrated River Tow"

Source: Rob A. Godfrey
University of Michigan
May 1967

Relevant Information:

This paper contained the results of still-water model tests of a fully integrated river tow. The test results from a conventional tow configuration were also included. Finally, a comparison was made between the effective horsepower of a fully integrated tow and a conventional tow configuration with similar dimensions.

Title: "A Design Study of a Fully Integrated River Tow"

Source: Robert A. Godfrey
University of Michigan
May 1968

Relevant Information:

This paper outlined the development of the design of a fully integrated river tow. Speed-power relationships, trade economics, and various equipment configurations were discussed.

Title: "Design and Economics of Integrated Tug- Barge Systems"

Source: Robert P. Gibbon and Robert J. Tapcott
Marine Technology, SNAME
July 1973

Relevant Information:

This paper discussed the reason for the current interest in integrated tug-barges and outlined their history leading up to current developments in design. Propulsion plants were discussed with a comparison of single and twin-screw propulsion systems. This paper also discussed a number of applications, both commercial and military, for which integrated tug-barge systems would be particularly applicable because of the flexibility offered to the detachable, interchangeable, power plant (tug), and the relative lower first cost and operating cost when compared with a ship. The relative economics of tug-barge tankers operating under the U.S. flag were examined for both an international route and a domestic service.

Title: "Powering Study Technique Applied to a Pusher Tug Geared Diesel Installation"

Source: Robert Latone
Marine Technology
April 1972

Relevant Information:

This paper presented a rational approach to the selection of the main components of a medium speed marine diesel installation. The technique described matched the engine, reduction gear, and propeller and determines a measure of merit for each combination. This matching calculation was based on the speed-power characteristics of the vessel's hull, essential information about the trade route, and vendor's prices. A computer program developed using this design technique was presented with the results of a pusher tugboat powering study.

Title: "Medium Tug Design, with Particular Emphasis on Maneuverability, Propeller Design, and Endurance"

Source: Doros Argyriadis
1957, Sname

Relevant Information:

Significant features of tugboat design were presented. Stability of towboats was presented, and maneuverability, relating to rudder design and engine controls was emphasized. Specific mathematical formulae were given for rudder area calculations. In addition, endurance of engine performance at reduced speeds was discussed.

Title: "Tugboat Design"

Source: C.D. Roach
1954, Sname

Relevant Information:

This paper discussed three general types of tug designs employed in the United States; 1) sea-going and salvage, 2) harbor, and 3) utility tugs. General design and engineering characteristics were presented.

Title: "Tug Design"

Source: F. Westhorp
April 1974

Relevant Information:

This paper discussed in general terms, the basic design characteristics of miscellaneous types of tugboats.

Title: "Barge Transportation"

Source: Captain George C. Steinman, USCG
Presented at CGA Transportation Symposium
"New Technique in Transportation",
January 1964

Relevant Information:

The purpose of this paper was stated as the presentation of new design techniques to be used in the construction of barges that will transport so-called dangerous and hazardous cargoes. The proposed method of assuring safe transport requires a determination of a classification of the hazards associated with each chemical cargo, and then relating the structural adequacy of the barge and its associated tanks, piping, etc. to the degree of hazard involved.

Title: "Rationale of Tug and Barge Transportation"

Source: Donal G. McAllister, et al
McAllister Towing, Ltd.
March 1967

Relevant Information:

The fundamental development of the deep sea tug and the large ocean barge as competitive transportation was discussed. Versatility factors, tonnage and operation requirements, as well as comparative data on operating costs were presented. Many charts citing specific ships were given. In addition, a brief discussion of the development of the design of the large ocean barge was discussed.

Title: "Barge Transportation System and Barge Towing Tugs"

Source: Robert Allan
Robert Allan Ltd.

Relevant Information

This paper represented the author's experience centered largely on the coastal waters of British Columbia, and adjacent to the United States territory of Alaska and Washington, generally known as the Pacific North West.

Title: "Commercial Transportation on the Inland Waterways"

Source: George Grunthaner
1962, Sname

Relevant Information:

This paper primarily addressed barge transportation on the Mississippi River. The need for river transportation, its origin, problems, and status were discussed.

Title: "Inland Waterborne Commerce Statistics"

Source: U.S. Department of Commerce
1973

Relevant Information:

The data is this report illustrated the economical statistics for the towing industry in 1973. Included in this data was the total amount of tonnage transported, and the total ton-miles of service performed nationally.

Title: "Inland Waterway Transportation - Studies in Public and Private Management and Investment Decisions"

Source: Department of Transportation
1969

Relevant Information:

These studies were designed to develop tools of economic analysis that could be used to improve the economic efficiency of public and private investment in shallow-water inland transportation.

Title: "Role of the Tug in Coastal Trade"

Source: Ralph W. Hooper
1973

Relevant Information:

The development of seaborn transport in terms of vessel types and problems was discussed. In addition, future prospects were briefly addressed.

Title: "A Study of the Inland Waterway Use Charge Program"

Source: Charles River Association
December 1970

Relevant Information:

This study examined the economic implications of numerous proposed user charge methods, such as economic efficiency, equity, and administrative simplicity.

GENERAL BACKGROUND

Title: "Large Tug/Barge Systems - An Overview "

Source: Chris Wright
1973

Relevant Information:

This presentation consisted of a brief history of tug/barge concepts and a survey of the economics involved.

Title: "Big Load Afloat"

Source: American Waterway Operators, Inc.

Relevant Information:

This book provided insight to the many factors involving towboat operations. These factors included waterway economics, ports, terminals, safety, public involvement, the human factor aboard, and an explanation of the different types of barges.

Title: "Great Lakes Piloting Review"

Source: Department of Transportation
May 1972

Relevant Information:

This report was a broad review of the Great Lakes pilotage system. The purpose was to evaluate the present system and determine its future requirements for pilotage. Part II of this report addressed both the pilot employment status and the training requirements. Apprenticeship and prescribed courses of instruction, necessary for pilot's professional competance were discussed.

Title: "Rules of the Road - International and Inland"

Source: United States Coast Guard
September 1965

Relevant Information:

This publication contains International Regulations for preventing collisions at sea and on the inland waterways. Specifically, Part 84, entitled, "Towing of Barges", cites the rules governing tows of sea-going barges within inland waters, hawser lengths for inland water tows, and the bunching of tows.

Title: "Farwell's Rules of the Nautical Road"

Source: Captain Raymond F. Farwell
July 1969

Relevant Information:

This book was written to be a useful handbook for officers at sea in the practice of navigation. It contained numerous statuatory, regulatory domestic and international nautical rules. Lighting requirements for barges and tows in specific waterways were referenced, as were the different water conditions and barge configurations.

Title: "Transocean Tug-Barge Systems - A Conceptual Study"

Source: Dr. Ernest Koenizsberg
Matson Research Corporation
July 1970

Relevant Information:

This report explored the general advantages of transocean transportation systems with separable propulsion units (tugs and barges) in direct competition with systems without separable propulsion units (self-propelled ships). The purpose of this report was also to determine what technological and institutional problems must be solved before the inherent advantages of tug-barge systems can be realized.

Title: "The Need for Licensed Engineers Aboard Uninspected Towing Vessels"

Source: The Marine Engineers Beneficial Association,AFL-CIO
January 1973

Relevant Information:

This report states the Marine Engineers Beneficial Association (MEBA) case for requiring that engineers be licensed on the nearly 6,000 uninspected tow boats that travel the nation's coastal and inland water routes. Some Coast Guard accident reports were presented in which the implication was made that a

large number of accidents attributable to engine-room casualties could have been prevented if the engine-room had been manned by a licensed engineer.

Title: "Tugs, Towboats, and Towing"

Source: Edward M. Brady
Cornell Maritime Press,
1967

Relevant Information:

The intent of this book was to be a reference manual of towboat operations for towboat industry personnel. A spectrum of topics, including basic theory, design considerations for both ocean and inland towboats, various piloting techniques and hazards were explained.

Title: "Study of the Inland Waterway Situation"

Source: Samuel S. Ayer
Fuel-Power - Transportation Educational Foundation
August 1931

Relevant Information:

This study discussed the development of the inland waterway up until that time. In addition, it briefly described man's dependence on, and navigation of the inland waterways.

Title: "Big River Barge Operations Would Stun Mark Twain"

Source: Charles E. Rotkin
Smithsonian Institution
August 1975

Relevant Information

This article was a pictoral, story-book account of life on a Mississippi tow. It is primarily an informative, human interest account of towing operations.

Title: "Towboat " Wilbur Mills" Can Push 45,000 Tons of Cargo"

Source: Marine Engineering Log
May 1971

Relevant Information:

This article described the technical and operational characteristics of the "M/V Wilbur Mills". This new, triple-screw 8400 HP towboat could handle tows carrying up to 45,000 tons. In addition, she was one of the more highly automated towboats in service when she was initially launched.

Title: "New Towboat Joins the UMTC Fleet"

Source: Marine Engineering Log
July 1971

Relevant Information:

This article described the technical and operational characteristics of a new triple-screw towboat, to be used on the inland waterway.

Title: "Dravo Delivers M/V "Rita Darto" to Mississippi Valley Barge Line"

Source" Maritime Reporter and Engineering News
May 1967

Relevant Information:

This article described the technical and operational characteristics of this all steel towboat, which is designed to push large tows of up to forty barges on the Mississippi River.

Title: "Crossing the Potomac with a Pipe in Tow"

Source" Washington Post
October 23, 1975

Relevant Information:

This article referenced the pipeline that was being laid across the Patuxent and Potomac Rivers, for transport of natural gas. The towboat pilot was interviewed concerning his life on the inland waterways.

APPENDIX C

1975 CASUALTY DATA FORMS

ID 52052 RIVER Tennessee, Mile 304.4

BRIDGE Southern RR, Decateur

CASUALTY DESCRIPTION:

Made passage thru hwy bridge OK. Had trouble lining up for RR bridge. Hit bridge lightly first time and backed upstream for second attempt. Hit right descending bridge pier and became jammed by current.

REASON FOR CASUALTY:

Strong right hand draft caused out-of-shape at RR bridge.

MASTER DATA: AGE 44 YRS. EXP. 18 LIC: YES X NO ___

TOWBOAT DATA: GT 359 LENGTH 116

HP 3600 PROPULSION Diesel NO. SCREWS 2

DRAFT: FWD 7' AFT 7'

MOVEMENT: UPRIVER ___ DOWNRIVER X

BARGE DATA: PUSHING X TOWING ___ HIP ___

INTEGRATED: YES X NO ___, NO. BARGES 4

BARGE TONNAGE Light TOW LENGTH 504

WIDTH OF TOW 100 DRAFT; FWD. 2' AFT. 2'

WX/TIME/RIVER: DATE 3/18/75 ,TIME 0010

CURRENT SPEED ___ VISIBILITY Fair

WIND; VELOCITY 10 KTS DIRECTION SE

REMARKS:

DAMAGE TO BRIDGE: $100,000.00

DAMGE TO TOW AND CARGO: NONE

ID 52939 RIVER UMR, Mile 383.9

BRIDGE Santa Fe RR, Ft Madison

CASUALTY DESCRIPTION:

Port side of barge rubbed piling.

REASON FOR CASUALTY:

Strong draft to port as a result of medium current flow.

MASTER DATA: AGE ____ YRS. EXP. ____ LIC: YES ____ NO ____

TOWBOAT DATA: GT 307 LENGTH 124

** HP 3000 PROPULSION Diesel NO. SCREWS ____

DRAFT: FWD 8'-6" AFT 8'_6"

MOVEMENT: UPRIVER ____ DOWNRIVER X

*BARGE DATA: PUSHING ____ TOWING ____ HIP ____

INTEGRATED: YES ____ NO ____, NO. BARGES ____

BARGE TONNAGE 1700 TOW LENGTH ____

WIDTH OF TOW ____ DRAFT; FWD. 8' AFT. 8'

WX/TIME/RIVER: DATE 6/7/75 ,TIME 2230

CURRENT SPEED Medium VISIBILITY Fair

WIND; VELOCITY u DIRECTION u

REMARKS: **Estimated HP

* Addendum report not included - poor data.

DAMAGE TO BRIDGE: $3,000.00

DAMGE TO TOW AND CARGO: 0

ID 41969 RIVER LMR, Mile 531.3

BRIDGE Greenville Highway

CASUALTY DESCRIPTION:

Lead barge hit right descending pier. Tow got out-of-shape in bend due to slide toward right descending shore.

REASON FOR CASUALTY:

High water conditions and strong right hand draft at bridge plus NE wind.

MASTER DATA: AGE 36 YRS. EXP. 12 LIC: YES X NO ___

TOWBOAT DATA: GT 580 LENGTH 148.2'

HP 2650 PROPULSION Diesel NO. SCREWS 2

DRAFT: FWD 7'-10" AFT 9'-8"

MOVEMENT: UPRIVER ___ DOWNRIVER X

BARGE DATA: PUSHING X TOWING ___ HIP ___

INTEGRATED: YES ___ NO X , NO. BARGES 9

BARGE TONNAGE Light TOW LENGTH 790

WIDTH OF TOW 124 DRAFT; FWD. 1'-6" AFT. 1'-6"

WX/TIME/RIVER: DATE 1/25/74 ,TIME 2330

CURRENT SPEED 10 - 15 MPH VISIBILITY 1 mile

*WIND; VELOCITY 10 - 13 KTS DIRECTION NE

REMARKS: *Narrative gives wind velocity as 15-20 MPH. Good narrative description

DAMAGE TO BRIDGE: 0

DAMGE TO TOW AND CARGO: $58,000.00

ID 51120 RIVER LMR, Mile 531.3

BRIDGE Greenville Hwy

CASUALTY DESCRIPTION:

Tow went into reverse one mile above bridge. Could not stop and head of port string of barges hit right hand pier.

REASON FOR CASUALTY:

Swift current and strong right hand draft. Got out-of-shape a mile above bridge.

MASTER DATA: AGE 40 YRS. EXP. 16 LIC: YES X NO ___

TOWBOAT DATA: GT 674 LENGTH 152.5

**HP 4800 PROPULSION Diesel NO. SCREWS 2

DRAFT: FWD 8'-6" AFT 8'-6"

MOVEMENT: UPRIVER ___ DOWNRIVER X

BARGE DATA: PUSHING X TOWING ___ HIP ___

INTEGRATED: YES ___ NO X , NO. BARGES 30

BARGE TONNAGE 42,000 TOW LENGTH 1,000

WIDTH OF TOW 175 DRAFT; FWD. 8'-6" AFT. 8'-6"

WX/TIME/RIVER: DATE 11/16/74 ,TIME 1415 CST

CURRENT SPEED High VISIBILITY 4 miles

WIND; VELOCITY none DIRECTION Westerly

REMARKS:

*estimated

DAMAGE TO BRIDGE: 0

DAMGE TO TOW AND CARGO: $17,000.00

ID 51445 RIVER LMR, Mile 531.3

BRIDGE Greenville Hwy

CASUALTY DESCRIPTION:

Lead barge on port string struck pier.

REASON FOR CASUALTY:

Swift current and strong left hand draft caused slide.

MASTER DATA: AGE 46 YRS. EXP. 15 LIC: YES X NO ___

TOWBOAT DATA: GT 244 LENGTH 90

HP 1800 PROPULSION Diesel NO. SCREWS u

DRAFT: FWD 8' AFT 8'

MOVEMENT: UPRIVER ___ DOWNRIVER X

BARGE DATA: PUSHING X TOWING ___ HIP ___

INTEGRATED: YES ___ NO X , NO. BARGES 10

BARGE TONNAGE LIGHT TOW LENGTH 1300

WIDTH OF TOW 100' DRAFT; FWD. 3'-6" AFT. 2'-6"

WX/TIME/RIVER: DATE 1/1/75 ,TIME 0110 CST

CURRENT SPEED Swift VISIBILITY 2 miles

WIND; VELOCITY 10-20 KTS DIRECTION NE

REMARKS:

DAMAGE TO BRIDGE: 0

DAMGE TO TOW AND CARGO: $20,000.00

ID 51757 RIVER LMR, Mile 531.3

BRIDGE Greenville Hwy

CASUALTY DESCRIPTION:

Head of tow drifted to left - operator backed full to stop tow from hitting bridge. Two lead barges in starboard string hit left hand pier.

REASON FOR CASUALTY:

Swift current and strong left hand draft.

MASTER DATA: AGE ____ YRS. EXP. ____ LIC: YES X NO ____

TOWBOAT DATA: GT 1137 LENGTH 176

HP 6600 PROPULSION Diesel NO. SCREWS ____

DRAFT: FWD 8' AFT 8'

MOVEMENT: UPRIVER ____ DOWNRIVER X

BARGE DATA: PUSHING X TOWING ____ HIP ____

INTEGRATED: YES X NO ____, NO. BARGES 4 light and 17 loaded

BARGE TONNAGE 23,000 TOW LENGTH 1,000

WIDTH OF TOW 175 DRAFT; FWD. variable AFT. variable

WX/TIME/RIVER: DATE 2/5/75 ,TIME 0045 CST

CURRENT SPEED Swift VISIBILITY Good

WIND; VELOCITY u DIRECTION u

REMARKS:

DAMAGE TO BRIDGE: 0

DAMGE TO TOW AND CARGO: $22,600.00

ID 51816 RIVER LMR, Mile 531.3

BRIDGE Greenville Hwy

CASUALTY DESCRIPTION:

Set too far to right, backed full to avoid bridge. Head of tow struck right hand pier.

REASON FOR CASUALTY:

Current and strong right hand draft.

MASTER DATA: AGE 46 YRS. EXP. 20 LIC: YES X NO ___

TOWBOAT DATA: GT 1108 LENGTH 192

HP 6400 PROPULSION Diesel NO. SCREWS 2

DRAFT: FWD 9'-6" AFT 9'-6"

MOVEMENT: UPRIVER ___ DOWNRIVER X

BARGE DATA: PUSHING X TOWING ___ HIP ___

INTEGRATED: YES ___ NO X, NO. BARGES 16 light and 12 loaded

BARGE TONNAGE 12,000 TOW LENGTH 1,370

WIDTH OF TOW 140 DRAFT; FWD. Variable AFT. Variable

WX/TIME/RIVER: DATE 2/9/75 ,TIME 2220 CST

CURRENT SPEED u VISIBILITY poor

WIND; VELOCITY u DIRECTION u

REMARKS:

DAMAGE TO BRIDGE: 0

DAMGE TO TOW AND CARGO: $12,500.00

ID 52114 RIVER LMR, Mile 531.3

BRIDGE Greenville Hwy

CASUALTY DESCRIPTION:

Attempting to flank left span, tow drifted too far to left. Operator went into full reverse. Port string barges struck left bridge pier.

REASON FOR CASUALTY:

Swift current and strong left hand draft.

MASTER DATA: AGE 49 YRS. EXP. 15 LIC: YES X NO ___

TOWBOAT DATA: GT 1108 LENGTH 192

HP 6400 PROPULSION Diesel NO. SCREWS 2

DRAFT: FWD 9.5 AFT 9.5

MOVEMENT: UPRIVER ___ DOWNRIVER X

BARGE DATA: PUSHING X TOWING ___ HIP ___

INTEGRATED: YES X NO ___, NO. BARGES 28

BARGE TONNAGE 39,000 TOW LENGTH 1300'

WIDTH OF TOW 140' DRAFT; FWD. 8'-10" loaded 1'-8" light AFT. 8'-10" loaded 1'-8" light

WX/TIME/RIVER: DATE 3/26/75 ,TIME 2200 CDT

CURRENT SPEED Swift VISIBILITY 2 miles

WIND; VELOCITY u DIRECTION u

REMARKS:

DAMAGE TO BRIDGE: 0

DAMGE TO TOW AND CARGO: $7,000.00

ID 52665 RIVER LMR, Mile 531.3

BRIDGE Greenville Hwy

CASUALTY DESCRIPTION:

Head of tow set to right. Operator steered to left to avoid right hand pier. Starboard stern barge struck right hand pier.

REASON FOR CASUALTY:

Swift current and strong right hand draft.

MASTER DATA: AGE ___ YRS. EXP. ___ LIC: YES X NO ___

TOWBOAT DATA: GT 674 LENGTH 152.5'

** HP 5000 PROPULSION Diesel NO. SCREWS ___

DRAFT: FWD 9' AFT 9'-3"

MOVEMENT: UPRIVER ___ DOWNRIVER X

* BARGE DATA: PUSHING ___ TOWING ___ HIP ___

INTEGRATED: YES ___ NO ___, NO. BARGES 25

BARGE TONNAGE ___ TOW LENGTH ** 975

**WIDTH OF TOW 175 DRAFT; FWD. ___ AFT. ___

WX/TIME/RIVER: DATE 4/7/75, TIME 2125 CDST

CURRENT SPEED ___ VISIBILITY 3 miles

WIND; VELOCITY none DIRECTION -

REMARKS: *addendum report missing
** estimated

DAMAGE TO BRIDGE: 0

DAMGE TO TOW AND CARGO: $320,000.00

ID 50012 RIVER Atchafalaya

BRIDGE Berwick RR

CASUALTY DESCRIPTION:

Towboat with headboat assistance hit left descending bridge pier.

Headboat:
GT = 57
L = 47
HP = 750
Screws = 3
Hip Breast Connection

REASON FOR CASUALTY:

Strong current set tow toward east pier. Parted cable also blamed.

MASTER DATA: AGE 39 YRS. EXP. 10 LIC: YES X NO

* TOWBOAT DATA: GT 116 LENGTH 61

HP 760 PROPULSION Diesel NO. SCREWS 2

DRAFT: FWD 6' AFT 6'

MOVEMENT: UPRIVER DOWNRIVER X

BARGE DATA: PUSHING X TOWING HIP

INTEGRATED: YES NO X, NO. BARGES 2 empty, 2 loaded

BARGE TONNAGE 2695 TOW LENGTH 780

WIDTH OF TOW 35 DRAFT; FWD. 8'-6" loaded AFT. 8'-6" loaded

WX/TIME/RIVER: DATE 4/27/74, TIME 2345

CURRENT SPEED u VISIBILITY 3 miles

WIND; VELOCITY 10 kts DIRECTION SE

REMARKS:

*Data on pushing towboat, see upper right for data on headboat

DAMAGE TO BRIDGE: 0

DAMGE TO TOW AND CARGO: $5688.00

ID 53011 RIVER Atchafalaya

BRIDGE Berwick RR & Hwy 90 bridges

CASUALTY DESCRIPTION:

Struck RR pier breaking cable. Then struck Hwy 90 bridge and tow broke up.

REASON FOR CASUALTY:

Lack of operator experience in area. Tow started to slide in swift current.

MASTER DATA: AGE 31 YRS. EXP. 2 LIC: YES X NO ___

TOWBOAT DATA: GT 479 LENGTH 125

HP 2800 PROPULSION diesel NO. SCREWS 2

DRAFT: FWD 9' AFT 9'

MOVEMENT: UPRIVER X DOWNRIVER ___

BARGE DATA: PUSHING X TOWING ___ HIP ___

INTEGRATED: YES ___ NO X , NO. BARGES 4

BARGE TONNAGE 10,000 TOW LENGTH 1025

WIDTH OF TOW 54 DRAFT; FWD. 9' AFT. 9'

WX/TIME/RIVER: DATE 12/13/74 ,TIME 0300 CST

CURRENT SPEED u VISIBILITY u

WIND; VELOCITY u DIRECTION u

REMARKS:

DAMAGE TO BRIDGE: 0

DAMGE TO TOW AND CARGO: $10,000.00

ID 42233 RIVER Atchafalaya

BRIDGE Berwick RR

CASUALTY DESCRIPTION:

Not clear - see sketch

REASON FOR CASUALTY:

Swift river current - alledged momentary steering failure.

MASTER DATA: AGE 54 YRS. EXP. 30 LIC: YES X NO ___

TOWBOAT DATA: GT 47 LENGTH 22.1

HP 720 PROPULSION diesel NO. SCREWS 2

DRAFT: FWD 8.5 AFT 9.0

MOVEMENT: UPRIVER ___ DOWNRIVER X

BARGE DATA: PUSHING X TOWING ___ HIP ___

INTEGRATED: YES X NO ___, NO. BARGES 2

BARGE TONNAGE 1190 TOW LENGTH 458

WIDTH OF TOW 35 DRAFT; FWD. 8.5 AFT. 9.0

WX/TIME/RIVER: DATE 7/3/73, TIME 2230 CST

CURRENT SPEED ___ VISIBILITY ___

WIND; VELOCITY ___ DIRECTION SE

REMARKS:

DAMAGE TO BRIDGE: 0

DAMGE TO TOW AND CARGO: $11,000.00

ID 50204 RIVER Atchafalaya

BRIDGE Berwick RR

CASUALTY DESCRIPTION:

Hit east fender of RR bridge

REASON FOR CASUALTY:

Current caused out-of-shape.

MASTER DATA: AGE 37 YRS. EXP. 20 LIC: YES X NO

TOWBOAT DATA: GT 201 LENGTH 78

HP 1020 PROPULSION diesel NO. SCREWS 2

DRAFT: FWD 7.5' AFT 7.5'

MOVEMENT: UPRIVER DOWNRIVER X

BARGE DATA: PUSHING X TOWING HIP

INTEGRATED: YES X NO , NO. BARGES 5 light, 1 loaded

BARGE TONNAGE u TOW LENGTH 1070

WIDTH OF TOW 50 DRAFT; FWD. 1.5 light AFT. 1.5 light

WX/TIME/RIVER: DATE 6/30/74 ,TIME 0600

CURRENT SPEED 2-5 mph VISIBILITY 4 mi.

WIND; VELOCITY 10-15kts DIRECTION SE

REMARKS:

DAMAGE TO BRIDGE:

DAMGE TO TOW AND CARGO: u

ID 32460 RIVER Atchafalaya

BRIDGE Berwick RR

CASUALTY DESCRIPTION:

Towboat pushing plus headboat for assist thru bridge

Headboat-
GT = 201
L = 78.2
HP = 1020
Screws = 2

REASON FOR CASUALTY:

Current set tow broadside against fender system. Strong left hand draft.

MASTER DATA: AGE 33 YRS. EXP. 6 LIC: YES ____ NO X

* TOWBOAT DATA: GT 261 LENGTH 78

HP 1020 PROPULSION diesel NO. SCREWS 2

DRAFT: FWD 2'-3" AFT 2'-3"

MOVEMENT: UPRIVER ____ DOWNRIVER X

BARGE DATA: PUSHING X TOWING ____ HIP ____

INTEGRATED: YES ____ NO X, NO. BARGES 3

BARGE TONNAGE light TOW LENGTH 490

WIDTH OF TOW 52 DRAFT; FWD. 1'-6" AFT. 1'-6"

WX/TIME/RIVER: DATE 2/5/73, TIME 0515

CURRENT SPEED ____ VISIBILITY 3-5 mi

WIND; VELOCITY 7 kts DIRECTION SSE

REMARKS:

*Based on pushing towboat - see headboat data above right.

DAMAGE TO BRIDGE: 0

DAMGE TO TOW AND CARGO: $4,000.00

ID 51510 RIVER Atchafalaya

BRIDGE Berwick RR

CASUALTY DESCRIPTION:

Pushing upriver at RR bridge when tow lines broke between third and fourth barge.

REASON FOR CASUALTY:

not clear

MASTER DATA: AGE 25 YRS. EXP. 10 LIC: YES X NO

TOWBOAT DATA: GT 247 LENGTH 93

HP 1700 PROPULSION diesel NO. SCREWS 2

DRAFT: FWD 8'-6" AFT 8'-6"

MOVEMENT: UPRIVER X DOWNRIVER

BARGE DATA: PUSHING X TOWING HIP

INTEGRATED: YES X NO , NO. BARGES 7

BARGE TONNAGE 9862 TOW LENGTH 1183

WIDTH OF TOW 50 DRAFT; FWD. 8'-6" AFT. 8'-6"

WX/TIME/RIVER: DATE 1/1/75 ,TIME 2350 CST

CURRENT SPEED VISIBILITY 1 mile

WIND; VELOCITY 15 kts DIRECTION N

REMARKS:

DAMAGE TO BRIDGE: 0

DAMGE TO TOW AND CARGO: $7,000.00

ID 52425 RIVER Atchafalaya

BRIDGE Berwick Hwy 90

CASUALTY DESCRIPTION:

Struck pier-west pier.

REASON FOR CASUALTY:

Swift current caused tow to slide and get out of shape - good narrative

MASTER DATA: AGE 45 YRS. EXP. 5 LIC: YES X NO

TOWBOAT DATA: GT 116 LENGTH 61.1

HP 760 PROPULSION Diesel NO. SCREWS 2

DRAFT: FWD 6' AFT 6'

MOVEMENT: UPRIVER DOWNRIVER X

BARGE DATA: PUSHING X TOWING HIP

INTEGRATED: YES NO X, NO. BARGES 2

BARGE TONNAGE 2600 TOW LENGTH 390

WIDTH OF TOW 35 DRAFT; FWD. 9' AFT. 9'

WX/TIME/RIVER: DATE 3/17/75, TIME 2305 CST

CURRENT SPEED u VISIBILITY Fair

WIND; VELOCITY u DIRECTION u

REMARKS:

DAMAGE TO BRIDGE: $1,500.00

DAMGE TO TOW AND CARGO: $500.00

ID 51042 RIVER Atchafalaya

BRIDGE Berwick RR

CASUALTY DESCRIPTION:

Struck left descending pier.

REASON FOR CASUALTY:

Got out of shape above the highway bridge - missed highway bridge but set to left on RR pier.

MASTER DATA: AGE 24 YRS. EXP. 4 LIC: YES X NO

TOWBOAT DATA: GT 157 LENGTH 78

HP 1020 PROPULSION diesel NO. SCREWS 2

DRAFT: FWD 8'-6" AFT 8'-6"

MOVEMENT: UPRIVER DOWNRIVER X

BARGE DATA: PUSHING X TOWING HIP

INTEGRATED: YES NO X , NO. BARGES 2

BARGE TONNAGE 4400 TOW LENGTH 558

WIDTH OF TOW 50 DRAFT; FWD. 9'-6" AFT. 9'-6"

WX/TIME/RIVER: DATE 3/5/75 ,TIME 0150 CST

CURRENT SPEED u VISIBILITY 2 miles

WIND; VELOCITY u DIRECTION u

REMARKS:

DAMAGE TO BRIDGE: 0

DAMGE TO TOW AND CARGO: 0

ID 50824 RIVER Atchafalaya

BRIDGE Berwick RR

CASUALTY DESCRIPTION:

Out of shape above highway bridge - too far toward west shore. Hit RR bridge at r a 45 degree angle - see narrative & sketch.

REASON FOR CASUALTY:

Had to back down above hwy bridge to allow northbound traffic thru. Broached in current

MASTER DATA: AGE 47 YRS. EXP. 16 LIC: YES X NO ___

TOWBOAT DATA: GT 94 LENGTH 64.4

HP 670 PROPULSION Diesel NO. SCREWS 1

DRAFT: FWD 7.5 AFT 7.5

MOVEMENT: UPRIVER ___ DOWNRIVER X

BARGE DATA: PUSHING X TOWING ___ HIP ___

INTEGRATED: YES ___ NO X , NO. BARGES 3

BARGE TONNAGE light TOW LENGTH 706

WIDTH OF TOW 52.5 DRAFT; FWD. 2' AFT. 2'

WX/TIME/RIVER: DATE 7/10/74 ,TIME 0748

*CURRENT SPEED 3-5 mph VISIBILITY unlimited

WIND; VELOCITY 7 kts DIRECTION SE

REMARKS:

*narrative data

DAMAGE TO BRIDGE: $66,000.00

DAMGE TO TOW AND CARGO: $14,000.00

ID 51582 RIVER Atchafalaya

BRIDGE Berwick RR

CASUALTY DESCRIPTION:

Struck left descending pier.

Headboat:

GT = 82
L = 56.9
HP = 600
Screws = 2
Hip breast position

REASON FOR CASUALTY:

Strong current and unusual eddy caused tow to slide into left descending pier.

MASTER DATA: AGE 49 YRS. EXP. 16 LIC: YES ___ NO X

TOWBOAT DATA: GT 48 LENGTH 58

HP 1000 PROPULSION diesel NO. SCREWS 2

DRAFT: FWD 1.5' AFT 6'

MOVEMENT: UPRIVER ___ DOWNRIVER X

BARGE DATA: PUSHING X TOWING ___ HIP ___

INTEGRATED: YES X NO ___, NO. BARGES 3 loaded, 1 empty

BARGE TONNAGE 2100 TOW LENGTH 780

WIDTH OF TOW 50 DRAFT; FWD. ___ AFT. ___

WX/TIME/RIVER: DATE 1/13/75 ,TIME 1600 CST

CURRENT SPEED 4 mph VISIBILITY clear

WIND; VELOCITY 5-15 mph DIRECTION S

REMARKS:

DAMAGE TO BRIDGE: $25,000.00

DAMGE TO TOW AND CARGO: $1,000.00

ID 53248 RIVER Atchafalaya

BRIDGE Berwick Railroad

CASUALTY DESCRIPTION:

Lead barge struck left descending pier. Narrative states he got out-of-shape at Conrad Shipyard - current set him toward Berwick side.

REASON FOR CASUALTY:

Current set tow to left at railroad bridge - failure to properly line-up.

MASTER DATA: AGE 36 YRS. EXP. 10 LIC: YES ✓ NO

TOWBOAT DATA: GT 123 LENGTH 65.5

HP 1550 PROPULSION Diesel NO. SCREWS 3

DRAFT: FWD 9.5 AFT 9.5

MOVEMENT: UPRIVER DOWNRIVER ✓

BARGE DATA: PUSHING ✓ TOWING HIP

INTEGRATED: YES ✓ NO , NO. BARGES 2

BARGE TONNAGE Loaded TOW LENGTH 580

WIDTH OF TOW 50 DRAFT; FWD. 9' AFT. 9'

WX/TIME/RIVER: DATE 3/17/75 ,TIME 1545 DST

CURRENT SPEED 4-5 Kts. VISIBILITY Good

WIND; VELOCITY 5-10 Kts. DIRECTION S

REMARKS:

*Data from narrative.

DAMAGE TO BRIDGE: 0

DAMGE TO TOW AND CARGO: $3,300.00

APPENDIX D

LOCAL NOTICE TO MARINERS

BERWICK BAY LOUISIANA

COAST GUARD

LOCAL NOTICE TO MARINERS

Issued by: Commander, Eighth Coast Guard District
Customhouse, New Orleans, Louisiana 70130
Phone: 504-527-6234 or 504-527-6225

LOUISIANA - - ATCHAFALYA RIVER and
INTRACOASTAL WATERWAY - - MORGAN CITY - PORT ALLEN (Alternate Route)

Atchafalaya River, La; special order to govern navigation through the reach of the Lower Atchafalaya River (Berwick Bay) in the vicinity of the Southern Pacific Railroad Bridge and both highway bridges at Morgan City, La.

1) The Commander, Eighth Coast Guard District has determined that an emergency condition exists due to the velocity of the flow of the Atchafalaya River in the vicinity of the Southern Pacific Railroad Bridge and both highway bridges at Morgan City, Louisiana, and finds it necessary to issue this order governing the movement of vessels and the composition of tows through each of those bridges. The following order is effective immediately, under the authority of 33 CFR 6.04.

2) Day and night visual signals will be displayed prominently on the Southern Pacific Railroad Bridge when this order is in effect. During periods of foggy or inclement weather, or when for any other reason the visual signals cannot be be seen, notice that the signals are being displayed will be given by blasts of a fog horn located on the bridge. To indicate that signals are being displayed to govern traffic moving through the bridges, one blast of six (6) seconds duration will be sounded on air horn each minute.

3) By day the visual signals will consist of two red balls, two feet in diameter displayed one above the other not less than four nor more than six feet apart, from a pole, to indicate that vessels and tows moving through the bridges shall be governed by this order.

4) At night the visual signal will consist of two focused, flashing white lights visible 360 degrees, of such character as to be visible on a dark night with a clear atmosphere for a distance of at least two (2) miles, displayed vertically one above the other, not less than four (4) feet nor more than six (6) feet apart.

DATE: 13 JANUARY 1973 SPECIAL NOTICE NO. 1-73

5) When the signals described in paragraphs 2, 3, and 4 of this order are displayed, unless otherwise directed by the Commander, Eighth Coast Guard District, tows (except as described below) moving southward through any of the three bridge openings shall not exceed one barge or other vessel in addition to the towing vessel. Tows moving northward through any of the three bridge openings shall not exceed two barges or other vessels arranged in tandem in addition to the towing vessel. Towing on a hawser in either direction shall not be permitted. Tows shall move through the bridge openings at a minimum speed required to maintain steerageway.

6) The restrictions as to size of tows described in paragraph 5 of this order shall not apply to an integrated tow consisting of bow section, middle box sections and stern section, with the push boat made up rigidly astern.

7) The restrictions as to size of tows described in paragraph 5 of this order shall not apply to tows with two towing vessels, one at the head and one at the stern of the tow, nor shall they apply to tows with bow steering units.

8) No tow may proceed through any of the three bridge openings unless the towing vessel is of sufficient horsepower. Towing vessels less than 1000 horsepower each are deemed to have insufficient horsepower to tow barges carrying particularity hazardous cargo.

9) "PARTICULARLY HAZARDOUS CARGO" as used in this order shall mean;

A. 1) Explosives, class A (commercial or military).
   2) Oxidizing materials for which a special permit for water transportation is required by 46 CFR 146.
   3) Radioactive materials for which special approval by the Commandant for water transportation is required by 46 CFR 146.
   4) Any dangerous cargo considered to involve a particular hazard, when transported or handled in bulk quantities, as further described in paragraph (B) of this section.

B. 1) A dangerous cargo considered to involve a particular hazard, when transported in bulk quantities on board vessels is any commodity which by virture of its properties would create an unusual hazard it released. The commodities subject to this section are:

Acetaldehyde	Ethylene oxide
Acetone cyanohydrin	Hydrochloric acid
Acetonitrile	Methane
Acrylonitrile	Methyl acrylate
Allyl Alcohol	Methyl bromide
Ammonia, anhydrous	Methyl chloride
Aniline	Methyl Methacrylate (monomer).
Butadienne	Oleum
Carbolic oil	Phenol
Carbon disulfide	Phosphorus, elemental
Chlorine	Propane
Chlorohydrins, cruce	Propylene
Crotonaldehyde	Propylene oxide
1,2 Dichloropropane	Sulfuric acid, spent
Epichlorohydrin	Vinyl acetate
Ethylene	Vinyl chloride
Ehtyl ether	Vinylidene chloride

2) Each commodity listed in subparagraph (1) of this paragraph is considered to posses one or more of the following properties:

i. Is highly reactive or unstable; or;
ii. Has severe or unusual fire hazards; or
iii. Has severe toxic properties; or
iv. Requires refrigeration for its safe containment; or
v. Can cause brittle fracture of normal ship structural materials or ashore containment materials by reason of its being carried at low temperatures, or because of its low boiling point at atmospheric pressure (unless uncontrolled release of the cargo is not a major hazard to life).

10) Vessels and tows preceeding with the current shall have the right of way over vessels and tows proceeding against the current. When two vessels or tows are about to enter the navigation opening through the bridges from opposite directions at the same time, the vessel or tow proceeding against the current shall stop short of the opening until the vessel or tow having the right of way shall have passed through.

11) Vessels and tows desiring to pass through the navigation opening of any of the three bridges shall approach the opening along the axis of the channel and shall proceed with due regard for direction and velocity of the current and for any tendency to drift either to the right or to the left so as to pass through without danger of striking the navigation opening of the Southern Pacific Railroad Bridge until it is fully open.

12) The bridge tender of the Southern Pacific Railroad Bridge is available on 156.650 MHz and 156.8 (channels 13 and 16) for information regarding the lift span and the marine traffic in the vicinity of the bridge.

13) Violation of this order is punishable by forfeiture of the vessel and its equipment, and a fine of not more than $10,000.00, and imprisonment for not more than 10 years. 50 USC 192, 33 CFR 6.18-1.

14) This order is effective immediately for barges carrying chlorine; this order is effective for southbound traffic at 6:00 PM CST, Monday, 15 January 1973; this order is effective for northbound traffic at 6:00 PM CST, Monday, 22 January 1973.

JOHN D. McCUBBIN
Rear Admiral, U.S. Coast Guard
Commander, Eighth Coast Guard District

COAST GUARD

LOCAL NOTICE TO MARINERS

Issued by: Commander, Eighth Coast Guard District
Customhouse, New Orleans, Louisiana 70130
Phone: 504-527-6234 or 504-527-6225

LOUISIANA - - ATCHAFALAYA RIVER and
INTRACOASTAL WATERWAY - - MORGAN CITY - PORT ALLEN (Alternate Route)

Atchafalaya River, La. and Morgan City-to-Port Allen alternate route; special order to govern navigation in and through the Lower Atchafalaya River (Berwick Bay).

1) The Commander, Eighth Coast Guard District has determined that an emergency condition exists due to the velocity of the flow and high water conditions of the Atchafalaya River in the vicinity of the Southern Pacific Railroad Bridge and both highway bridges at Morgan City, Louisiana. The emergency consists of (1) substantial threat of vessels and their tows causing damage to waterfront facilities, or structures or themselves through drastically reduced maneuvering capabilities and (2) damage to sandbagged areas or seawalls or structures and facilities caused by the wave wash of passing vessels. It is anticipated that this already grave situation will worsen as additional quantities of water are channeled into the Atchafalaya floodway as a result of opening the Morganza Spillway. Heavy rainfalls over the region have also contributed to the problem.

2) It is therefore ordered that Berwick Bay between the Southern Pacific Railroad Bridge and Stouts Pass be closed to thru marine navigation except for emergencies as determined by Commander, Eighth Coast Guard District. Accordingly, both the Atchafalaya River route between Old River lock and Stouts Pass as well as the Morgan City-Port Allen alternate route below Bayou Sorrel are closed to marine traffic bound through Berwick Bay.

3) The U. S. Army Corps of Engineers advise that they have closed the Landside Route due to the high water condition.

4) Thru traffic downbound in the Morgan City-Port Allen alternate route and/or Atchafalaya route at 3:27 P.M., 17 April 1973 will be allowed passage after obtaining clearance from the Coast Guard Cutter POINT LOOKOUT on 156.650 mHz and 156.8 mHz (on Channel 13 and/or 16 MHF/FM) and clearance must be obtained prior to entering the swift waters of Berwick Bay.

DATE: 18 APRIL 1973 SPECIAL NOTICE NO. 2-73

5) The Southern Pacific Railroad Bridge will open twice daily, once in the morning and once in the late afternoon to permit local marine interests operating <u>single vessels only</u> to arrive at or depart from the Ports of Morgan City and Berwick. Advance notification to the bridge tender of the Sourthern Pacific Railroad Bridge is required.

6) The bridge tender of the Sourthern Pacific Railroad Bridge is available on channels 13 and 16 VHF/FM for the advance notification.

7) All vessels in the effected areas and especially in the Berwick Bay area must proceed so as to create a minimum of wave wash.

8) This order is effective immediately and issued under the authority of 33 CFR 6.04. The day and night signals previously displayed have no effect.

9) Information as to when this order is in effect will be disseminated by the Army Corps to Engineers Locks at Old River, Port Allen, Bayou Sorrel and Bayou Boeuf.

10) Commander, Eighth Coast Guard District Special Notice to Mariners No. 2-73 (this order) is effective immediately and temporarily supersedes Special Notice to Mariners No. 1-73.

11) Violation of this order is punishable by forfeiture of the vessel and its equipment, and a fine of not more than $10,000.00, and imprisonment for not more than 10 year. 50 USC 192, 33 CFR 6.18-1.

JOHN D. McCUBBIN
Rear Admiral, U.S. Coast Guard
Commander, Eighth Coast Guard District

COAST GUARD

LOCAL NOTICE TO MARINERS

Issued by: Commander, Eighth Coast Guard District
Customhouse, New Orleans, Louisiana 70130
Phone: 504-527-6234 or 504-527-6225

LOUISIANA - - ATCHAFALYA RIVER and
INTRACOASTAL WATERWAY - - MORGAN CITY - PORT ALLEN (Alternate Route)

Atchafalaya River, La: special order to govern naviagtion through the reach of the Lower Atchafalaya River (Berwick Bay) in the vicinity of t Southern Pacific Railroad Bridge and both highway bridges at Morgan City, L

1) The Commander, Eighth Coast Guard District has determined th an emergency condition exists due to the velocity of the flo the Atchafalaya River in the vicinity of the Southern Pacifi Railroad Bridge and both highway bridges at Morgan City, Louisiana, and finds it necessary to issue this order govern ing the movement of vessels and the composition of tows thro each of those bridges. The following order isissued, under authority of 33 CFR 6.04.

2) Day and night visual signals will be displayed prominently o Southern Pacific Railroad Bridge when this order is in effec During periods of foggy or inclement weather, or when for an other reason the visual signals cannot be seen, notice that signals are being displayed will be given by blasts of a fog horn located on the bridge. To indicate that signals are be displayed to govern traffic moving through the bridges, one blast of six (6) seconds duration will be sounded on air hor each minute.

3) By day the visual signals will consist of two red balls, two feet in diameter displayed one above the other not less than nor more than six feet apart, from a pole, to indicate that sels and tows moving through the bridges shall be governed b this order.

4) At night the visual signal will consist of two focused, flas white lights visible 360 degrees, of such character as to be visible on a dark night with a clear atmosphere for a distan of at least two (2) miles, displayed vertically one above th other, not less than four (4) feet nor more than six (6) fee apart.

DATE: 13 JANUARY 1974 SPECIAL NOTICE NO. 1-74

5) When the signals described in paragraphs 2, 3, and 4 of this order are displayed, unless otherwise directed by the Commander, Eighth Coast Guard District, tows (except as described below) moving southward through any of the three bridge openings shall not exceed two barges or other vessels arranged in tandem in addition to the towing bessel. Towing on a hawser in either direction shall not be permitted. Tows shall move through the bridge openings at a minimum speed required to maintain steerageway.

6) The restrictions as to size of tows described in paragraph 5 of this order shall not apply to an integrated tow consisting of a bow section, with or without a middle box section or sections and a stern section arranged in tandem securely lashed together with the push boat made up rigidly astern. The "bow section" of the tow, commonly referred to as the lead barge, shall have a raked bow and a square stern. Any "middle box section" shall have square ends. The "stern section", commonly referred to as the integrated tow must have virtually the same beam and draft so as to present a nearly uniform and unbroken underwater hull shape. Variations in draft and beam between any two adjacent barges shall not exceed ten percent of the draft of that barge in the two drawing the most water and shall not exceed 10 percent of the beam of the widest barge in the tow.

7) The restrictions as to size of tows described in paragraph 5 of this order shall not apply to tows with two towing vessels, one at the head and one at the stern of the tow, nor shall they apply to tows with bow steering units.

8) No tow may proceed through any of the three bridge openings unless the towing vessel is of sufficient horsepower. Towing vessels less than 1000 horsepower each are deemed to have insufficient horsepower to tow barges carrying particularity hazardous cargo.

9) "PARTICULARLY HAZARDOUS CARGO" as used in this order shall mean;

A. 1) Explosives, class A (commercial or military).
   2) Oxidizing materials for which a special permit for water transportation is required by 46 CFR 146.
   3) Radioactive materials for which special approval by the Commandant for water transportation is required by 46 CFR 146.
   4) Any dangerous cargo considered to involve a particular hazard, when transported or handled in bulk quantities, as further described in paragraph (B) of this section.

B. 1) A dangerous cargo considered to involve a particular hazard, when transported in bulk quantities on board vessels is any commodity which by virtue of its properties would create an unusual hazard if released. The commodities subject to this section are:

Acetaldehyde
Acetone cyanohydrin
Acetonitrile
Acrylonitrile
Allyl Alcohol
Ammonia, anhydrous
Aniline
Butadienne
Carbolic oil
Carbon disulfide
Methane
Methyl scrylate
Methyl bromide
Methyl chloride
Methyl Methacrylate (monomer).
Oleum
Phenol
Phosphorus, elemental
Chlorine
Chlorohydrins, crude
Crotonaldehyde
1, 2 Dichloropropane
Dichloropropene
Epichlorohydrin
Ethylene
Ethyl ether
Ethylene oxide
Hydrochloric acid
Propane
Propylene
Propylene oxide
Sulfuric acid
Sulfuric acid, spent
Vinyl acetate
Vinyl chloride
Vinylidene chloride

2) Each commodity listed in subparagrph (1) of this paragraph is considered to posses one or more of the following properties:

i. Is highly reactive or unstable; or;
ii. Has severe or unusual fire hazards; or
iii. Has severe toxic properties; or
iv. Requires refrigeration for its safe containment; or
v. Can cause brittle fracture of normal ship structural materials or ashore containment materials by reason of its low boiling point at atmospheric pressure (unless uncontrolled release of the cargo is not a major hazard of life).

10) Vessels and tows proceeding with the current shall have the right of way over vessels and tows proceeding against the current. When two vessels or tows are about to enter the navigation opening through the bridges from opposite directions at the same time, the vessel or tow proceeding against the current shall stop short of the opening until the vessel or tow having the right of way shall have passed through.

11) Vessels and tows desiring to pass through the naviagtion opening of any of the three bridges shall approach the opening along the axis of the channel and shall proceed with due regard for direction and velocity of the channel and shall proceed with due regard for direction and velocity of the current and for any tendency to drift either to the right or to the left so as to pass through without danger of striking the bridges or their fenders. No vessel shall attempt passage through the naviagation opening of the Southern Pacific Railroad Bridge until it is fully open.

12) The bridge tender of the Southern Pacific Railroad Bridge is available on 156.650 MHz and 156.8MHz (channels 13 and 16) for information regarding the lift span and the marine traffic in the vicinity of the bridge.

13) Violation of this order is punishable by forfeiture of the vessel and its equipment, and a fine of not more than $10,000.00, and imprisonment for not more than 10 years. 50 USC 192, 33 CFR 6.18-1.

14) This order is effective for all marine traffic using the Atchafalaya River Route and the Morgan City-Port Allen Alternate Route commencing at Six O'Clock A.M. Central Daylight Time, Friday, January 11, 1974.

ELLIS L. PERRY

COAST GUARD

LOCAL NOTICE TO MARINERS

Issued by: Commander, Eighth Coast Guard District
Customhouse, New Orleans, Louisiana 70130
Phone: 504-527-6234 or 504-527-6225

LOUISIANA - - ATCHAFALAYA RIVER and
INTRACOASTAL WATERWAY - - MORGAN CITY - - PORT ALLEN (Alternate Route)

Atchafalaya River, Louisiana, Special Order to assist traffic through the reach of the Lower Atchafalaya River (Berwick Bay) in the vicinity of the Southern Pacific Railroad Bridge and both highway bridges at Morgan City, Louisiana.

1) BACKGROUND. On 3 January 1974, by Special Notice to Mariners 1-74, the Commander, Eighth Coast Guard District, determined that an emergency condition exists due to the velocity of the flow of the Atchafalaya River in the vicinity of the Southern Pacific Railroad Bridge and both highway bridges at Morgan City, Louisiana, Special Notice 1-74 governs the movement of vessels and the composition of tows through the bridges.

2) PURPOSE.

a. General: In order to enhance the safety of navigation through these waterways, this Special Notice 2-74 establishes an advisory Vessel Traffic System on the Atchafalaya River and Gulf Intercoastal Waterway in the Morgan City-Berwick Bay Area, with mandatory reporting for certain types of vessels and voluntary compliance by other vessels. This Special Notice 2-74 amends paragraph 12 of Special Notice 1-74 insofar as the system will provide the position of the Southern Pacific Railroad Bridge and marine traffic information.

b. Specific: The heart of the system will be a Vessel Traffic Center manned by the Coast Guard which will relay navigational safety information collected from masters or persons in charge of vessels and from the bridge tender of the Southern Pacific Railroad Bridge. The Vessel Traffic Center will disseminate that information to other vessels within the system so as to encourage mutual planning over the Bridge to Bridge Radio Telephone. The Vessel Traffic Center may make recommendations to vessels, but these recommendations will be advisory in nature. Compliance with any recommendation is encouraged but not mandatory.

3) APPLICATION.

a. The following vessels are required to report into and out of the system:

1) Every power driven vessel of 300 gross tons and upward while navigating.

2) Every vessel of 100 gross tons and upward carrying one or more passengers for hire while navigating;

3) Every towing vessel of 26 feet or over in length while navigating.

4) Every dredge and floating plant engaged in or near a channel or fairway in operations likely to restrict or affect navigation of other vessels;

5) Crewboats equipped with radio;

6) Fishing vessels equipped with radio.

b. Any vessels not required above to meet the system requirements are strongly encouraged to do so in order that the system may be of maximum protection and benefit to all users of the waterways serving the Morgan City-Berwick Bay Traffic System area.

4) DEFINITION OF TERMS

a. Vessel Traffic System (VTS). Vessel Traffic System is a generic term coined to encompass a variety of technologies employed to cope with the problem of vessel movements in or approaching a port area. In its broadest context the term embraces vessel navigation, communications, surveillance, information display, and certain decision processes.

b. Vessel Traffic Center. The facility manned by U.S. Coast Guard personnel which has communications capability to collect and disseminate information. The Center monitors and advices participating vessel traffic within the Vessel Traffic System area and provides information concerning traffic conditions, weather, aids to navigation, unusual operations, and navigational hazards to participating vessels. A Coast Guard vessel in the vicinity of Berwick Bay will function as the Vessel Traffic Center.

c. Initial Communication. The radio contact which a vessel makes with the Vessel Traffic Center at the time or place, specified herein, preparatory to entering the Vessel Traffic

System. In this communication, the Vessel Traffic Center is given certain information describing the vessel, including tow if applicable, and its movement.

d. Rules of the Road. The statutes and regulations governing the navigation of vessels. (The compilation of these rules is published in Coast Guard Pamphlet 169, "Rules of the Road - International and Inland.")

e. Vessels. Any watercraft propelled by machinery.

5) DESCRIPTION OF THE SYSTEM.

a. Geographic Boundaries. All points on the Atchafalaya River between Stouts Point and the junction of Lower Atchafalaya River and Little Wax Bayou (LCW Light #2), and all points on the ICW between the northern tip of Long Island (MC-PA Alt. route) the eastern end of Bayou Boeuf locks, and the junction of Lower Atchafalaya River and Little Wax Bayou (ICW Light "2").

b. Vessel Traffic Center. The Vessel Traffic Center will maintain a continuous listening watch on Channel 13 (156.65 MHz) VHF-FM, Channel 16 (156.8 MHz) VHF-FM, and 2738 KHz (HF-AM).

c. Reporting Points.

1. The reporting points are the northern tip of Long Island, Stouts Point, junction of Lower Atchafalaya River and Little Wax Bayou (ICW Light "2), and the eastern end of Bayou Boeuf Locks. All vessels covered by the system shall contact the Vessel Traffic Center when a beam of these points. In the case of vessels entering Bayou Boeuf Locks Westward an additional report of leaving the locks will be given.

2. Additionally, any vessel moored within the geographic boundaries of the system shall contact the Vessel Traffic Center prior to unmooring.

6) OPERATING PROCEDURES.

a. General Information.

1. To insure the success and efficient operation of the Morgan City-Berwick Bay Vessel Traffic System, all participating vessels must observe these operating procedures. Participation in the system is mandatory for vessels falling under the Vessel Bridge-to-Bridge Radio telephone Act, and for all other vessels listed in paragraph 3(a) (Application).

2. The purpose of the Morgan City-Berwick Bay Vessel Traffic System is not to attempt to maneuver or navigate vessels from shore. Nothing in these procedures should be construed as contravening or modifying the Rules of the Road.

3. The Vessel Traffic Center will give recommendations concerning entries into the system or movement within the system. The Center will also issue advisory messages on conditions affecting safety of navigation. However, the Master is not relieved of his traditional responsibility for safe navigation of his vessel.

b. <u>Communications Procedures</u>.

1. Vessels subject to the Bridge-to-Bridge Radio Telephone Act shall call and work the "Vessel Traffic Center" on channel 13 (156.65 MHz). All other vessels shall use channel 13 (156.65 MHz). if so equipped. Vessels not equipped with channel 13 (156.65 MHz) shall call and work the Vessel Traffic Center on 2738 KHz. Channel 16 (156.8 MHz) will be used only if a vessel is unable to communicate with the Vessel Traffic Center on Channel 13 (156.65 MHz) or 2738 KHz. Transmissions must be limited to the exchange of navigational safety information and be transmitted at the lowest possible power ratings.

2. Nothing in these procedures should be construed as contravening or modifying the Vessel Bridge-to-Bridge Radiotelephone Act. The communications required between vessels by the Act shall be transmitted on Channel 13.

3. The call sign of the Vessel Traffic Center is "Berwick Bay Traffic Center". After communications have been established, the abbreviated call sign "Traffic Center" may be used.

4. Vessels will initiate communications with the Vessel Traffic Center in the following instances:

   a. To enter the system.
   b. To report passing an established reporting point.
   c. To request navigation information.
   d. To report leaving system.
   e. To report an item of navigation safety which might affect other vessels.

c. Reporting Procedures.

1. All participating vessels are required to furnish the following information when making the initial communication with the Vessel Traffic Center:

   a. Name of vessel and horsepower.
   b. Number of barges and kind of cargo.
   c. Present location.
   d. Route and destination.
   e. ETA a beam Southern Pacific Railway Bridge.

2. After initial communication has been made, any vessel which will have a 10 minute change in its ETA abeam Southern Pacific Railway Bridge shall contact the Berwick Vessel Traffic Center at the earliest possible moment.

3. Using the information provided by the vessels within the boundaries of the system and the Southern Pacific Railroad Bridge the Berwick Bay Traffic Center will provide advisory information concerning marine traffic in the vicinity of the Southern Pacific Railroad Bridge to vessels reporting into the center, or upon request from any vessel.

4. While the traffic system is in operation, all vessels will arrange for passage through the Southern Pacific Railroad Bridge by contacting the "Berwick Bay Vessel Traffic Center" rather than the bridge.

7) EMERGENCIES.

a. Vessels losing communication with the Berwick Traffic Center after entering the system should communicate with the Southern Pacific Railroad Bridge as set forth in paragraph 12 of Special Notice to Mariners 1-74.

b. Under emergency conditions which prevent the Coast Guard vessel from functioning as the Berwick Vessel Traffic Center, the operation of the Vessel Traffic System may be suspended. Notice of such a suspension of operation and whether the waterway remains open for traffic will be given by a Notice to Mariners. If the Traffic systems operation is suspended but the waterway through the bridges between Morgan City and Berwick Bay remain open to traffic, vessels should also communicate with the Southern Pacific Railroad Bridge as set forth in paragraph 12 of Special Notice to Mariners 1-74.

8) MISCELLANEOUS. The establishment of the advisory vessel traffic system does not relieve any person from the obligation of compyling with the bridge-to-bridge radiotelephone regulations or the rules of the road. Mariners are reminded that Special Notice 1-74 contains an exception to the Rules of the Road, which grants right of way to vessels proceeding with the current.

9) EFFECTIVE DATE: This order is effective commencing at Six O'Clock A.M. Central Daylight Time, Saturday, February 16, 1974.

10) AUTHORITY AND PENALTY: This order is issued under the provisions of 33 CFR 6. Violation of this order is punishable by forfeiture of the vessel and its equipment and, a fine of not more than $10,000.00, and imprisonment for not more than 10 years. 33 CFR 6.18-1, 50 USC 192.

S. G. PUTZKE
CAPT, USCG
Commander, 8th CG District
Acting

COAST GUARD

LOCAL NOTICE TO MARINERS

Issued by: Commander, Eighth Coast Guard District
Customhouse, New Orleans, Louisiana 70130
Phone: 504-527-6234 or 504-527-6225

LOUISIANA - - ATCHAFALAYA RIVER and
INTRACOASTAL WATERWAY - - MORGAN CITY - - PORT ALLEN (Alternate Route)

Atchafalaya River, La; special order to govern navigation through the reach of the Lower Atchafalaya River (Berwick Bay) in the vicinity of the Southern Pacific Railroad Bridge and both highway bridges at Morgan City, La.

1) The Commander, Eighth Coast Guard District has determined that an emergency condition exists in the vicinity of the Southern Pacific Railroad Bridge and both highway bridges at Morgan City, Louisiana due to the damaged condition of the northeast dolphin of the Southern Pacific Railroad bridge, and finds it necessary to issue this order governing the movement of vessels and the composition of tows through each of those bridges. The following order is issued under the authority of 33 CFR 6.04.

2) Day and night visual signals will be displayed prominently on the Southern Pacific Railroad Bridge when this order is in effect. During periods of foggy or inclement weather, or when for any other reason the visual signals cannot be seen, notice that the signals are being displayed will be given by blasts of a fog horn located on the bridge. To indicate that signals are being displayed to govern traffic moving through the bridges, one blast of six (6) seconds duration will be sounded on air horn each minute.

3) By day the visual signals will consist of two red balls, two feet in diameter displayed one above the other not less than four nor more than six feet apart, from a pole, to indicate that vessels and tows moving through the bridges shall be governed by this order.

4) At night the visual signal will consist of two focused, flashing white lights visible 360 degrees, of such character as to be visible on a dark night with a clear atmosphere for a distance of at least two (2) miles, displayed vertically one above the other, not less than four (4) feet nor more than six (6) feet apart.

DATE: 12 AUGUST 1974 SPECIAL NOTICE NO. 5-74

5) When the signals described in paragraphs 2, 3, and 4 of this order are displayed, unless otherwise directed by the Commander, Eight Coast Guard District, tows (except as described below) moving southward through any of the three bridge openings shall not exceed one barge or other vessel in addition to the towing vessel. Tows moving northward through any of the three bridge openings shall not exceed two barges or other vessels arranged in tandem in addition to the towing vessel. Towing on a hawser in either direction shall not be permitted. Tows shall move through the bridge openings at the safest speed commensurate with existing conditions.

6) The restrictions as to size of tows described in paragraph 5 of this order shall not apply to an integrated tow consisting of a bow section, with or without a middle box section or sections and a stern section arranged in tandem securely lashed together with the push boat made up rigidly astern. The bow section of the tow, commonly referred to as the lead barge, shall have a raked bow and a square stern. Any middle box section shall have square ends. The stern section, commonly referred to sections in the integrated tow must have virtually the same beam and draft so as to present a nearly uniform and unbroken underwater hull draft so as to present a nearly uniform and unbroken underwater hull shape. Variations in draft and beam between any two adjacent barges shall not exceed ten percent of the draft of that barge in the tow drawing the most water and shall not exceed 10 percent of the beam of the widest barge in the tow.

7) The restrictions as to size of tows described in paragraph 5 of this order shall not apply to tows with two towing vessels, one at the head and one at the stern of the tow, nor shall they apply to tows with bow steering units.

8) No tow may proceed through any of the three bridge openings unless the towing vessel is of sufficient horsepower. Towing vessels less than 1000 horsepower each are deemed to have insufficient horsepower to tow barges carrying particularly hazardous cargo.

9) "PARTICULARLY HAZARDOUS CARGO" as used in this order shall mean:

A. 1) Explosives, class A (commercial or military).
   2) Oxidizing materials for which a special permit for water transportation is required by 46 CFR 146.
   3) Radioactive materials for which special approval by the Commandant for water transportation is required by 46 CFR 146.

4) Any dangerous cargo considered to involve a particular hazard, when transported or handled in bulk quantities, as further described in paragraph (b) of this section.

B. 1) A dangerous cargo considered to involve a particular hazard, when transported in bulk quantities on board vessels is any commodity which by virtue of its properties would create an unusual hazard if released. The commodities subject to this section are:

Acetaldehyde
Acetone cyanohydrin
Acetonitrile
Acrylonitrile
Allyl Alcohol
Ammonia, anhydrous
Aniline
Butadienne
Carbolic oil

Hydrochloric acid
Methane
Methyl acrylate
Methyl bromide
Methyl chloride
Methyl Methacrylate (monomer).
Oleum
Phenol
Phosphorus, elemental

Carbon disulfide
Chlorine
Chlorohydrins, crude
Crotonaldehyde
1 2 Dichloropropane
Dichloropropene
Epichlorohydrin
Ethylene
Ethyl ether
Ethylene oxide
Propane
Propylene
Propylene oxide
Sulfuric acid
Sulfuric acid, spent
Vinyl acetate
Vinyl chloride
Vinylidene chloride

2) Each commodity listed in subparagraph (1) of this paragraph is considered to possess one or more of the following properties:

i. Is highly reactive or unstable; or;
ii. Has severe or unusual fire hazards; or
iii. Has severe toxic properties; or
iv. Requires refrigeration for its safe containment; or
v. Can cause brittle fracture of normal ship structural materials or ashore containment materials by reason of its being carried at a low temperatures, or because of its low boiling point at atmospheric pressure (unless uncontrolled release of the cargo is not a major hazard to life).

10) Vessels and tows proceeding with the current shall have the right of way over vessels and tows proceeding against the current. When two vessels or tows are about to enter the navigation opening

through the bridges from opposite directions at the same time, the vessel or tow proceeding against the current shall stop short of the opening until the vessel or tow having the right of way shall have passed through.

11) Vessels and tows desiring to pass through the navigation opening of any of the three bridges shall approach the opening along the axis of the channel and shall proceed with due regard for direction and velocity of the current and for any tendency to drift either to the right or to the left so as to pass through without danger of striking the bridges or their fenders. No vessel shall attempt passage through the navigation opening of the Southern Pacific Railroad Bridge until it is fully open.

12) The bridge tender of the Southern Pacific Railroad Bridge is available on 156.650 MHz and 156.8 MHz (channels 13 and 16) for information regarding the lift span and the marine traffic in the vicinity of the bridge.

13) Violation of this order is punishable by forfeiture of the vessel and its equipment, and a fine of not more than $10,000.00, and imprisonment for not more than 10 years. 50 USC 192, 33 CFR 6.18-1.

14) This order cancels Special Notice to Mariners No. 1-74 of 3 January 1974. This order is effective for all marine traffic using the Atchafalaya River Route and the Morgan City-Port Allen Alternate Route commencing at six o'clock A.M. Central Daylight Time, Friday, August 16, 1974.

W. W. BARROW

COAST GUARD

LOCAL NOTICE TO MARINERS

Issued by: Commander, Eighth Coast Guard District
Customhouse, New Orleans, Louisiana 70130
Phone: 504-527-6234 or 504-527-6225

LOUISIANA - - ATCHAFALAYA RIVER and
INTRACOASTAL WATER - - MORGAN CITY - - PORT ALLEN (Alternate Route)

1) BACKGROUND. For a period of more than 20 years, the combination of navigational restrictions and periodic high water have created emergency conditions in the Berwick Bay area resulting in vessel collisions and bridge rammings. In order to alleviate the situation, the Southern Pacific Railroad Bridge lift span was aligned with the highway bridge span in 1971, under the Truman/Hobbs Act. Subsequently, in 1973 and 1974 special orders establishing operational restrictions on vessel traffic transiting the Berwick Bay area were placed into effect as well as a temporary Vessel Traffic System in 1974. While serious casualties have occurred most often during the high water period, traffic congestion, converging waterways, and navigational limitations combine to create a potentially hazardous area all during the year.

2) PURPOSE:

a. General. In order to enhance the safety of navigation through these waterways, this Special Notice 1-75 establishes the Berwick Bay Vessel Traffic System on the Atchafalaya River and Gulf Intracoastal Waterway in the Morgan City-Berwick Bay Area.

b. Specific. The heart of the system will be a Vessel Traffic Center manned by the Coast Guard. The Traffic Center is located in the SPRR Bridge-tender's station house and is equipped with radios on the frequencies specified in paragraph 3.a and a telephone. Based upon information provided by masters of vessels and the SPRR bridge-tender, the Vessel Traffic Center may make recommendations to coordinate the flow of traffic in the vicinity of and through the bridges across Berwick Bay. While the recommendations of the VTC to coordinate traffic flow are advisory in nature, compliance with the reporting requirements, operating procedures and high water vessel and traffic limitations is mandatory for those vessels which must participate in the vessel traffic system. Navigational safety information will be relayed by the Vessel Traffic Center. Mutual planning by vessels using the Bridge to Bridge Radio-telephone is encouraged.

3) APPLICATION.

a. Within the Vessel Traffic System area the provisions of this Special Notice apply to all vessels equipped to communicate on any of the following frequencies:

1) VHF-FM Channel 13 (156.65 MHz)
2) VHF-FM Channel 16 (156.8 MHz)
3) 2738 KHz
4) 2182 KHz

b. The provisions of this Special Notice to Mariners also apply to any other vessels intending to transit under the lift span of the SPRR bridge. For these vessels the Communications procedures specified in paragraph 6.b. can be satisfied by communicating with the VTC prior to transitting by telephone (504-385-2462) or other means.

4) DEFINITIONS.

a. Vessel Traffic Center (VTC) means the facility that operates the Berwick Bay Vessel Traffic System.

b. Vessel Traffic System area (VTS area) means the area described in paragraph 5.a.

c. ETA means estimated time of arrival.

d. Horsepower means horsepower as listed in "Merchant Vessel of the United States" (CG-408) or as appearing on the marine document of the vessel.

e. Bow Steering Unit means a power unit specifically designed for and adequate to provide lateral control to the head of the tow.

f. Master means master, pilot, operator or person in charge of a vessel.

g. Integrated Tow means a tow consisting of a lead barge and one or more box sections, or a lead barge and trailing barge with or without middle box sections. Variations in draft and beam shall not exceed ten percent of the draft of the barge drawing the most water and shall not exceed ten percent of the beam of the widest barge in the tow.

5) DANGEROUS CARGO

a. Dangerous cargo as used in this order shall mean:

1) Explosives, Class A (Commercial or Military).
2) Oxidizing materials for which a special permit for water transportation is required by 46 CFR 146.22.
3) Radioactive materials for which a special approval by the Commandant for water transportation is required by 46 CFR 146.25-30.
4) Any dangerous cargo considered to involve a particular hazard when transported or handled in bulk quantities, as further described in paragraph 5.b.

b. 1) A dangerous cargo considered to involve a particular hazard, when transported in bulk quantities on board vessels, is any commodity which by virtue of its properties would create an unusual hazard if released. These commodities are:

Acetaldehyde	Hydrochloric Acid
Acetone Cyanohydrin	Methane
Acetonitrile	Methyl Acrylate
Acrylonitrile	Methyl Bromide
Allyl Alcohol	Methyl Chloride
Allyl Chloride	Methyl Methacryalte (Monomer)
Ammonia, anhydrous	Methyl Phenol
Aniline	Oleum
Butadiene	Phenol
Carbolic oil	Phosphorus, elemental
Carbon disulfide	Propane
Chlorine	Propylene
Chlorohydrins, crude	Propylene Oxide
Crotonaldehyde	Sulfuric Acid
1, 2 - Dichloropropane	Sulfuric Acid, spent
Dichloropropene	Tetraethyl Lead
Epichlorohydrin	Tetraethyl Lead mixture
Ethylene	Vinyl Acetate
Ethyl Ether	Vinyl Chloride
Ethylene Oxide	Vinylidene Chloride

2) Each commodity listed in subparagraph 5.b.(1) is considered to possess one or more of the following properties:

a. Is highly reactive or unstable; or
b. Has severe or unusual fire hazards; or
c. Has severe toxic properties; or
d. Requires refrigeration for its safe containment; or
e. Can cause brittle fracture of normal ship structural

materials or ashore containment materials by reason of its being carried at low temperatures, or because of its low boiling point at atmospheric pressure (unless uncontrolled release of the cargo is not a major hazard to life).

6) DESCRIPTION OF THE SYSTEM

a. Geographic Boundaries. The VTS area consists of the segments of the waterways listed below:

1) The Intracoastal Waterway Morgan City to Port Allen Alternate Route from mile 0 to mile 7.
2) The Intracoastal Waterway from mile 93 WHL to mile 100 WHL.
3) The Atchafalaya River Route from mile 113 to mile 122.

b. Vessel Traffic Center. The Vessel Traffic Center located in the SPRR bridgetender building will maintain a continuous listening watch on the following frequencies:

1) VHF-FM Channel 13 (156.65 MHz)
2) VHF-FM Channel 16 (156.8 MHz)
3) 2738 KHz
4) 2182 KHz

c. Reporting Points. The reporting points are:

1) Stouts Point Light
2) Northern end of Long Island
3) Wax Bayou Junction Light A
4) Bayou Boeuf Lock

7) OPERATING PROCEDURES

a. General Information

1) Participation in the VTS is mandatory for those vessels listed in paragraphs 3.a and 3.b. Masters of all participating vessels must observe these operating procedures.
2) The purpose of the Berwick Bay VTS is not to attempt to maneuver or navigate vessels from shore, but to coordinate the flow of traffic through the VTS area.
3) Compliance with VTC recommendations should preclude the possibility of two vessels attempting passage through the bridge openings from opposite directions at the same time. However, in the event that due to communication loss or for other reasons that should occur, the

vessels and tows proceeding with the current shall have the right of way over vessels and tows proceeding against the current. When two vessels or tows are about to enter the navigation opening through the bridges from opposite directions at the same time, the vessel or tow proceeding against the current shall stop short and remain clear of the opening until the vessel or tow having the right of way shall have passed through.

4) The requirements stated herein are minimum requirements. It is the responsibility of the master to keep his vessel under control at all times and to determine whether a safe passage through the VTS area can be effected, giving due consideration to vessel power and maneuverability and to prevailing currents, weather, visibility and other vessel traffic. If conditions are not favorable, the master shall delay passage until conditions improve and a safe transit can be assured.

b. Communication Procedures.

1) Vessels in the VTS area shall continuously monitor one of the frequencies listed in paragraph 3.a. except when transmitting on that frequency. Vessels subject to the Bridge-to-Bridge Radiotelephone Act shall call and work the VTC on Channel 13. All other vessels shall use Channel 13 if so equipped. Vessels not equipped with VHF-FM shall call and work the VTC on 2738 KHz. Channel 16 and 2182 KHz will be used only if a vessel is unable to communicate with the VTC on Channel 13 or 2738 KHz. Transmissions must be limited to the exchange of navigational safety information and be transmitted at the lowest possible power ratings.

2) Nothing in these procedures should be construed as contravening or modifying the Vessel Bridge-to-Bridge Radiotelephone Act. The communications required between vessels by the Act shall be transmitted on Channel 13.

3) The call sign of the VTC is "Berwick Bay Vessel Traffic Center." After communications have been established, the abbreviated call sign "Berwick Traffic" may be used.

4) Vessels must communicate with the VTC in the following instances:

   a) To enter the system, including unmooring or weighing anchor within the VTS area.
   b) To report passing an established reporting point.
   c) To request navigational information.
   d) To report leaving the system, including mooring or anchoring within the VTS area.

e) To report any item of navigational safety which might affect other vessels in the VTS area.

c. Communication Failures.

1) Vessels intending to transit under the lift span of the SPRR bridge. Unless already cleared by the VTC, all vessels must contact the VTC by telephone (504-385-2462) or other means prior to passage. Vessels already cleared must exercise extreme caution while completing passage.

2) Vessels intending to transit only the ICW immediately south of the SPRR bridge. Towing vessels with tows must contact the VTC by telephone (504-385-2462) or other means prior to passage. Other vessels need not contact the VTC but must exercise extreme caution when passing through this section.

3) Vessels within the system but nor covered by paragraphs 6.c.(1) and 6.c.(2) above. All such vessels need not contact the VTC but should exercise extreme caution while in the VTS area.

d. Reporting Procedures

1) All vessels governed by this Special Notice are required to furnish the following information when making the initial communication with the VTC:

a) The name of the vessel
b) The type of vessel (crewboat, supply, fishing, towing, etc.)
c) The position of the vessel
d) Destination in or route through the VTS area.
e) ETA abeam Southern Pacific Railroad Bridge.
f) Any condition on the vessel that may affect its navigation in the VTS area such as fire, defective propulsion machinery, or defective steering equipment.
g) Whether or not any dangerous cargo as specified in paragraph 5 is on board. Additionally, towing vessels with tows that intend to transit the Lower Atchafalaya River (Berwick Bay) through the openings of the SPRR and highway bridges shall also furnish:
h) The horsepower and length of the towing vessel.
i) The total length of the tow (excluding the towing vessel).

2) After the initial communication has been made, any vessel whose ETA abeam the Southern Pacific Railroad Bridge will vary by more than ten (10) minutes shall provide the VTC with a revised ETA.
3) The VTC will coordinate the operation of the SPRR bridge lift span so separate radio communications to the SPRR bridgetender are unnecessary.

8) VESSEL AND TRAFFIC LIMITATIONS.

a. High Water Notification and Determination. High water vessel traffic limitations will be put in effect and removed by Notice to Mariners. High water will be considered to exist when the Morgan City River Gage reads three feet mean sea level or more for five consecutive days and is anticipated to remain at three feet or more for an additional five consecutive days. High water limitations will be removed when the Morgan City River Gage reads less than three feet for five consecutive days and is anticipated to remain at less than three feet for an additional five consecutive days.

b. High Water Vessel and Traffic Limitations. When the high water conditions exist, the following limitations apply to vessels transitting the navigational openings of the two highway bridges and the railroad bridge:

1) Towing on a hawser in either direction is prohibited.
2) Barges and towing vessels must be arranged in tandem.
3) Towing vessels with less than 1000 horsepower shall not tow barges with any dangerous cargo listed in paragraph 5.
4) Southbound tow limitations:

a) Non-integrated southbound tows without bow steering units shall not exceed one barge.
b) Integrated southbound tows without bow steering units shall not exceed 600 feet excluding the towboat.
c) Southbound tows with a bow steering unit shall not exceed 1180 feet including the towing vessel.

5) Northbound tow limitations:

a) Non-integrated northbound tows without bow steering units shall not exceed two barges.
b) Integrated northbound tows shall not exceed 1180 feet including the towing vessel.
c) Northbound tows with bow steering units shall not exceed 1180 feet including the towing vessel.
d) Northbound tows with a second towboat used on the lead barge shall not exceed 1180 feet including the towing vessels.

9) AUTHORIZATION TO DEVIATE. The Commander, Eighth Coast Guard District may upon request issue an authorization to deviate from any rule in this Special Notice if he finds that the proposed operations under the authorization can be done safely. A written application for an authorization must state the need for the authorization and describe the proposed operations.

10) EFFECTIVE DATE. This order is effective commencing at 12 o'clock Noon, Central Standard Time, Wednesday, January 15, 1975.

11) AUTHORITY AND PENALTY. This order is issued under the provisions of 33 CFR 6. Violation of this order is punishable by forfeiture of the vessel and its equipment and, a fine of not more than $10,000.00, and imprisonment for not more than 10 years. 50 USC 192, 33 CFR 6.18-1.

W. W. BARROW

APPENDIX E

INTERVIEW FORMS

PILOT INTERVIEW FORM

SUBJECT # 1 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Berwick Bay

ACTION: Ride Tow ✓, P to P Interview ✓, Tel. Interview ______

VESSEL NAME and HP: Texas

1. How many years

   a. As a towboat Captain 10

   b. How long have you been operating thru this segment of waterway 2

2. How did you become a towboat Captain? How did you enter the profession?

   Present tow - 2 barges - upbound thru Berwick Bay.

3. What are the worst bridge(s) in your experience?

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 4200 this tow to

      No. of screws? 2 this tow

      No. of types of rudders? Flanking and steering

   b. Barge:

      Push ✓ Tow Hip

      Integrated? Yes

      No. of barges? 2 to 12

      Width of tow? 2 abreast --

      Length of tow? 450 this tow 1200 maximum

      Loaded/unloaded trips? Up loaded, down empty, generally

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

1100' (1180' limit)

1 barge wide - 55' limit on width
(See Coast Guard Restrictions)

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current.

  c. Weather clear, daytime, light wind.

  d. Proceed downstream

  Operator too busy to do this. Pilot house is not a good environment for completing questionaire.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

g. Describe what makes this a difficult/easy passage?

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain:

- Have bridge area clear for southbound tows.
- Range - southbound hard to line up (not sufficient separation)
- Establish north range for southbound also.

<u>Case 2 River High (specify)</u>

- How does operation differ from Case 1?

Case 3 Loaded/Light (specify)

- How does operation differ from Case 1?

- How does operation differ from Case 2?

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

GENERAL DATA

- Operating Downstream
  1. How is steering (directional control) affected by:
     a. Going faster than current.
        - Little faster than current
        - Just enough for steerage
        - Would not go slower than current except in poor visibility
        - Downstream - hug east bank

b. Do you ever go the same speed as current (drifting)? Describe situation.

c. Do you ever go slower than current? Describe situation.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

3. Describe stopping procedure.

   Empty barges slide - harder to control than loaded.

4. Assume your tow is out-of-shape i.e., 30^{o} to normal track?

   a. Describe actions taken to correct, when loaded and when light.

5. What is cause of out-of-shape?

6. Why more accidents at night?

7. Is wind a problem for light tow? loaded tow?

8. Where is pivot point?

- Operating Upstream

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

    a. Bridge approach - describe

    b. Steering and control of tow

    c. Make-up of tow

- Have we missed anything important? Do you wish to add anything?

PILOT INTERVIEW FORM

SUBJECT # 2 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Berwick Bay

ACTION: Ride Tow________, P to P Interview________, Tel. Interview ✓

VESSEL NAME and HP:

1. How many years

   a. As a towboat Captain 1941

   b. How long have you been operating thru this segment of waterway off and on since 1941

2. How did you become a towboat Captain? How did you enter the profession?

   Started on deck - trained by captains - was operator at age 19.

3. What are the worst bridge(s) in your experience?

   - Natchez and Baton Rouge bridges not bad if in shape,
   - Parkersburg, West Virginia

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 3200 to 4300 thru Berwick Bay, prior to new railroad bridge 275 & 1300 HP

      No. of screws? 2 normally

      No. of types of rudders? flanking and steering

   b. Barge:

      Push ✓ Tow ______ Hip ______

      Integrated? ✓

      No. of barges? ______ to ______

      Width of tow? Single width thru Berwick Bay

      Length of tow? 1030' (4 barges) 1030' (7 barges)

      Loaded/unloaded trips? Unloaded downbound

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

Length	1030' (4 barges), 1030' (7 barges)
Width	Single width thru Berwick Bay
HP	3200 to 4300 thru Berwick Bay prior to new railroad bridge 275 and 1300 HP

NAVIGATION AND OPERATION

— PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current.

  c. Weather clear, daytime, light wind.

  d. Proceed downstream

DOWNSTREAM:

Pick up bow thruster at 9 if river high. If bow thruster not available wait and break up tow for 2 or more trips.

If river normal proceed at slow speed between 9 and 2 just slightly faster than current.

At 2 come ahead full and drive to hold stern in.

Favor west pier to offset east set of current between 2 and barge.

Drive thru bridges.

f. What inputs do you use, such as navigation aids, radio, visual, etc. (Circled numbers refer to chart)

- 6 uses fishermen sticks in this area.
- 6 - 2 shore structures as guide
- Green light at center of bridge span and range - pass between green light and west pier. If in proper shape.
- Pass close in to Conrad shipyard (see chart)

g. Describe what makes this a difficult/easy passage?
- Cross current in bridge vicinity
- Placement of west piers
- Closeness of bridges.

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain: • Keep buoys on station to prevent grounding tows.
- Bridge lites, day markers range adequate
- Flanking rudders a must in high water
- Stop southbound traffic at night during high water
- Allow traffic during day only with bow thrusters during high water.
- Put retroreflective markers on bridge piers (for night passage), red on Morgan City side, white on Berwick Bay side.
- Provide a safe mooring area at 9

Case 2 River High (specify)

- How does operation differ from Case 1?
  - Bow Thruster picked up at chart 3 if river high. If Bow Thruster not available he will wait. When river high, tow must be broken up to proceed (max. length 600').

Case 3 Loaded/Light (specify)

- How does operation differ from Case 1?

- How does operation differ from Case 2?

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

a. Met supply boat coming thru railroad bridge. Had to stop between railroad and highway bridge. Had 3200 HP and 4 barges (1030' empty.

b. Met fog at highway bridge - stopped and backed upstream to 9 to tie off.

GENERAL DATA

- Operating Downstream

1. How is steering (directional control) affected by:

   a. Going faster than current.

      Must go faster than current for steerage.

b. Do you ever go the same speed as current (drifting)? Describe situation.

No control.

c. Do you ever go slower than current? Describe situation.

Steerage only if you have flanking rudders.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

3. Describe stopping procedure.

Just reverse.

4. Assume your tow is out-of-shape i.e., 30° to normal track?

a. Describe actions taken to correct, when loaded and when light.

- Can tell if your out-of-shape by the time you get to Conrad shipyard.
- If out-of-shape at 2 go into reverse and line up (if you have the power).

5. What is cause of out-of-shape?

   Bend - causes change in current well across river.
   Current - current tends to drag stern out into center of channel (in vicinity Conrad shipyard).

6. Why more accidents at night?

   Poor visibility.

7. Is wind a problem for light tow? loaded tow?

   Yes - no problem for loaded barges.

8. Where is pivot point?

   About 1/3 distance back from bow in dead water. At higher speeds tow will slide when light.

• <u>Operating Upstream</u>

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

   a. Bridge approach - describe

   b. Steering and control of tow

   c. Make-up of tow

- Have we missed anything important? Do you wish to add anything?

PILOT INTERVIEW FORM

SUBJECT # 3 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Berwick Bay

ACTION: Ride Tow X, P to P Interview X, Tel. Interview ______

VESSEL NAME and HP: Silver City, 1170', 6 barges, plus bow steering unit

1. How many years

   a. As a towboat Captain 8

   b. How long have you been operating thru this segment of waterway 8

2. How did you become a towboat Captain? How did you enter the profession?

3. What are the worst bridge(s) in your experience?

4. What kind of tow configurations have you operated in the past year? Present tow details

   a. Towboat:

      HP 1200 to ______

      No. of screws? triple

      No. of types of rudders? flanking and steering

   b. Barge:

      Push ✓ Tow ______ Hip ______

      Integrated? No

      No. of barges? 6 to ______

      Width of tow? 82.5'

      Length of tow? 1170'

      Loaded/unloaded trips? 2 loaded - 4 light (downstream)

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

N/A

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current.

  c. Weather clear, daytime, light wind.

  d. Proceed downstream

DOWNSTREAM:

At ⑧ slow and check in with Vessel Traffic System operator.

Between ⑧ and ③ slow to round bend and hold close to Conrad Shipyard.

At ② drive toward bridge and align on west pier.

Bridge passage is between west pier and centerline of bridge span to offset current set toward the east.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

o Radio to VTS Berwick Bay
o Bow unit operating
o Eyeball navigation thru sections with no aids
o Conrad Point - cuts it close

Commercial lights along shore - a problem at night. Barges that stick out in river - (Conrad Point) should be lighted. Add retroreflector markers on bridge fenders.

g. Describe what makes this a difficult/easy passage?

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain:
Aids/buoy at junction Port Allen and Atchafalya mark shallow water both sides.

Case 2 River High (specify)

- How does operation differ from Case 1?

Case 3 Loaded/Light (specify)

- How does operation differ from Case 1?

- How does operation differ from Case 2?

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

GENERAL DATA

- Operating Downstream
  1. How is steering (directional control) affected by:
     a. Going faster than current.

b. Do you ever go the same speed as current (drifting)? Describe situation.

c. Do you ever go slower than current? Describe situation.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

3. Describe stopping procedure.

4. Assume your tow is out-of-shape i.e., 30° to normal track?
   a. Describe actions taken to correct, when loaded and when light.

5. What is cause of out-of-shape?

6. Why more accidents at night?

7. Is wind a problem for light tow? loaded tow?

8. Where is pivot point?

- <u>Operating Upstream</u>

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

   a. Bridge approach - describe

   b. Steering and control of tow

   c. Make-up of tow

- Have we missed anything important? Do you wish to add anything?

PILOT INTERVIEW FORM

SUBJECT # 4 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Berwick Bay

ACTION: Ride Tow ________, P to P Interview ________, Tel. Interview X

VESSEL NAME and HP: Sally Polk, 3200 HP

1. How many years

   a. As a towboat Captain since 1948 (retired since 1975)

   b. How long have you been operating thru this segment of waterway since 1947 off and on

2. How did you become a towboat Captain? How did you enter the profession?

   Father in towboat business (boat owner). Started in 1926, became steerman in 1932 for Federal Barge Line.
   Captain Whiteman has operated thru Vicksburg, Greenville & Fort Madison and is familiar with these bridges.

3. What are the worst bridge(s) in your experience?

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP - to 3200

      No. of screws? 2

      No. of types of rudders? 3 steering and 4 flanking

   b. Barge:

      Push X Tow ______ Hip ______

      Integrated? Integrated

      No. of barges? 0 to 7

      Width of tow? Single barge width

      Length of tow? 0 - 1200'* including towboat

      Loaded/unloaded trips? Varied - during last years ran between Houston, Port Arthur to Pittsburg, Freeport, Pa.

* 1150' restriction on intracoastal canal.

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

6-7 barges, 3200HP

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

<u>Case 1 Normal Environmental Conditions</u>

- Instructions to interviewee:
  - a. You are operating the typical tow previously described.
  - b. The river stage is normal, specify stage and current.
  - c. Weather clear, daytime, light wind.
  - d. Proceed downstream

e. Describe passage. Circled numbers refer to chart locations.

1. Hold chart upside down for descriptions
2. Course begins at Stouts Pass - see chart position 6
3. Enter Berwick Bay between 5 & 6
4. Current forces tow toward left descending shore at 5
5. Generally slow speed from 4 - 3 with intermittant use of high power to straighten out between 5 and 4.
6. At 4 steer toward left hand shore to offset right-hand draft.
7. Hug left shore down past 3 - current tries to force toward center of river.
8. Run between slow and half speed down to 3 going a little faster than current.
9. Should be shaped up by 2 - current attempts to get tow out-of-shape between 2 and 3.
10. Hold reduced speed thru bridges.
11. Enter highway bridge at middle.
12. Hug right descending pier of railroad bridge to offset left hand draft.
13. With long tow, you must back up as soon as you clear railroad bridge to flank and line up for passage down river.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Radio to VTS - for traffic information and clearance. VTS very helpful.
Radio and radar used at night.

g. Describe what makes this a difficult/easy passage?

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain:

Take your time in passage. Range not useful, will set you into left hand railroad pier.

Case 2 River High (specify)

- How does operation differ from Case 1?

About the same.

Case 3 Loaded/~~Light~~ (specify)

- How does operation differ from Case 1?
  Case 1 was for light tow. Generally don't set as fast with loaded tow. Wind no effect on loaded tow. Passage generally the same.

- How does operation differ from Case 2?

  Same.

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

No close calls with new railroad bridge.
Many close calls with old railroad bridge.

Tow width 54', old railroad bridge was 113' wide which only leaves 60' clearance total - no room to maneuver.

GENERAL DATA

- Operating Downstream
  1. How is steering (directional control) affected by:
     a. Going faster than current.

        Steering rudders used unless out-of-shape then reverse and use flanking rudders to straighten out. Must go faster than current to gain steerage.

b. Do you ever go the same speed as current (drifting)? Describe situation.

   No steerage - no control - must have headway to steer.

c. Do you ever go slower than current? Describe situation.

   Could do this to correct shape but must go ahead to have steerage going thru bridges.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

   NO

3. Describe stopping procedure.

   Reverse and keep in shape with flanking rudders.

4. Assume your tow is out-of-shape i.e., 30^{o} to normal track?

   a. Describe actions taken to correct, when loaded and when light.

      Back toward left bank using flanking rudders to regain alignment. This refers to Berwick Bay passage where stern is often forced toward mid river by current in vicinity of Conrad shipyard 3. Stern must be flanked toward left bank to straighten out.

AD-A036 732 OPERATIONS RESEARCH INC SILVER SPRING MD F/G 13/13
ANALYSIS OF BRIDGE COLLISION INCIDENTS. VOLUME II.(U)
DEC 76 R B DAYTON DOT-CG-31446-A
UNCLASSIFIED ORI-TR-1016-VOL-2 USCG-D-118-76 NL

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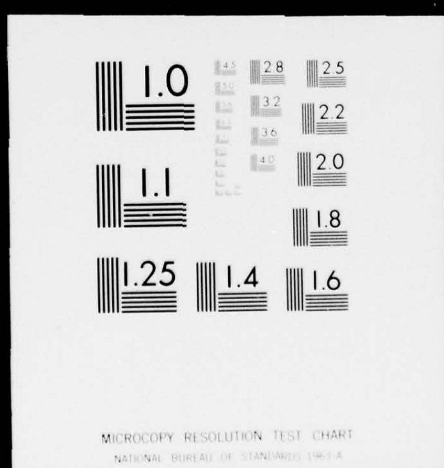


5. What is cause of out-of-shape?

Current and/or wind swings tow plus bad judgement on part of operator

6. Why more accidents at night?

Can't see as good. Radar a big help at night.

7. Is wind a problem for light tow? loaded tow?

Big problem with empty tow - side wind very difficult - 10 knots and up will effect tow - cause slide.

No effect on loaded tow.
Wind sets tow sideways - no rotation.

8. Where is pivot point?

Almost on head (lead barge).

- <u>Operating Upstream</u>

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

    a. Bridge approach - describe

    Favor Berwick Pier
    Can run middle of river
    Usually loaded tows going up river.

    b. Steering and control of tow

    Follow sailing line on chart and favor Morgan City side of sailing line.

    c. Make-up of tow

    Loaded and integrated.

- Have we missed anything important? Do you wish to add anything?

  Sometimes incoming tide at low river stage will cause an upstream current at bridges which changes conditions. Bridge tender will inform southbound tows.

PILOT INTERVIEW FORM

SUBJECT # 5.

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Berwick Bay

ACTION: Ride Tow______, P to P Interview______, Tel. Interview X

VESSEL NAME and HP: Marian Hagestad, 1760 hp
Hamilton - regular run thru Berwick from Houston to Chicago

1. How many years

   a. As a towboat Captain 11 years

   b. How long have you been operating thru this segment of waterway 11 years off and on

2. How did you become a towboat Captain? How did you enter the profession?

   Entered profession in 1955. Brother-in-law was engineer on towboat. Started on deck 4 years. Started as steersman after that--worked up to captain

3. What are the worst bridge(s) in your experience?

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 1760 to 4300

      No. of screws? all but one twin screw--one single screw*

      No. of types of rudders? 2 steering and 4 flanking

   b. Barge:

      Push X Tow ______ Hip ______

      Integrated? All integrated - chemical barges

      No. of barges? 2 to 7

      Width of tow? 50' single barge width

      Length of tow? 900' - maximum 1200' (restrictive in ICC)

      Loaded/unloaded trips? Loaded to Chicago - empty back

* Single screw no good for river work, can't use it for steering and if it goes out, your dead.

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current.

  c. Weather clear, daytime, light wind.

  d. Proceed downstream

  e. Describe passage. Circled numbers refer to chart locations.

1. Enter Berwick Bay from Port Allen Route
2. Hold red line from 9 through 7 - see chart for sailing line
3. Hold left descending side
4. Speed between 8 & 5 just sufficient to make steerage
5. Pick your sailing line and stick to it
6. Don't go below shipyard until traffic is clear
7. When you leave Conrad Shipyard 3 start to drive
8. Highway bridge no problem
9. At Conrad, line up on highway bridge green light
10. Current will set tow to right toward Berwick side between 3 and bridge
11. Favor right hand side of highway bridge

Case 1 -- Normal Environmental Conditions (Cont)

12. At highway bridge pick up range

13. Favor right hand side of RR bridge
    a. Expect left hand set between bridges

14. Must make a bard right hand turn after RR bridge be careful tow will slide toward range

15. On incoming tide, currents may cancel between bridges

16. Reason for driving from 3 thru bridges is -- with light tow speed builds up "pressure" (really hydrodynamic resistance) at head of tow which increases directional control and reduces tendency of light tow to slide.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

VTS, called to about 9 to check traffic. Will stop at 9 until traffic clear and traffic control tells him to proceed shore points.

No problem below beacon because water deep

Beacon used to shape up for RR bridge

VTS big help and needed in New Orleans harbor

Good water between beacon at 5 and bridge - no need for aids.

g. Describe what makes this a difficult/easy passage?

Traffic biggest problem. Once Conrad shipyard passed he does not want to stop.
Current difficult especially with small hp.
Low horsepower tows, range of (600-800 hp) has 900'-1000' of tow will go downriver without sufficient power to stop or maneuver.

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain:

- CG to restrict tonnage (size of tow) in relation to hp. during high water times
- Need HP/Ton relationships for high water times
- Move RR bridge up just north of Hwy bridge in straight section of river
- Need to limit tonnage per HP in areas with high current and at times of high current
- Add 2-3 buoys between 5 and 7 (see chart) to mark shallow water

Case 2 River High (specify)

- How does operation differ from Case 1?

  Same as Case 1 - same path in all cases

Case 3 Loaded/Light (specify)

- How does operation differ from Case 1?

  Same path loaded or light

- How does operation differ from Case 2?

  No change - path follows least current route and is good for all conditions

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

Small boat crossed in front of tow at Conrad Shipyard - caused tow to stop and get out of shape. Turned tow around and headed back upstream to 8 to make downstream run again.

GENERAL DATA

- Operating Downstream

  1. How is steering (directional control) affected by:

     a. Going faster than current.

     Slightly faster to keep steering 1/2 speed

b. Do you ever go the same speed as current (drifting)? Describe situation.

Can't steer - never do this

c. Do you ever go slower than current? Describe situation.

Don't do this except to get back in shape using flanking rudders

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

No

3. Describe stopping procedure.

Reverse and use flanking rudders to hold shape

4. Assume your tow is out-of-shape i.e., 30^{o} to normal track?

a. Describe actions taken to correct, when loaded and when light.

Back, flank and/or drift until back in shape

5. What is cause of out-of-shape?

6. Why more accidents at night?

Visibility restricted by darkness, distance judgement poor headway difficult to judge

Radar not helpful once past Conrad. Bridges cause reflections on radar

Radar is helpful at night

7. Is wind a problem for light tow? loaded tow?

Loaded - no, except if dead in water

Light - 15-20 mile wind is bad - biggest problem is wind with light barges.

8. Where is pivot point?

300' aft head barge on a 1200' tow

- <u>Operating Upstream</u>

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

   a. Bridge approach - describe

      See chart - pilot uses range to check position of stern

      Hold center of RR bridge

      Holds 6 mph northbound

   b. Steering and control of tow

   c. Make-up of tow

      Loaded and integrated

- Have we missed anything important? Do you wish to add anything?

  Retroreflective material helpful on bridge piers -
  (I suggested) for night operation

  Bad bridges--
  - Beardstown RR - has been replaced
  - Pearl Bridge (GM&O)

PILOT INTERVIEW FORM

SUBJECT # 6 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Morgan City

ACTION: Ride Tow________, P to P Interview________, Tel. Interview X

VESSEL NAME and HP: Marilyn M. II 1800 HP

1. How many years

   a. As a towboat Captain 15 years

   b. How long have you been operating thru this segment of waterway 22 years, 15 years as Captain

2. How did you become a towboat Captain? How did you enter the profession?
   Worked his way up as a deckhand. Helped the Captain by steering.

3. What are the worst bridge(s) in your experience?
   Morgan City is bad when you have a swift river.

   Greenville and Vicksburg can also be treacherous.

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 1800 to 3200 HP

      No. of screws? twin screw

      No. of types of rudders? 2 steering, 4 flanking

   b. Barge:

      Push X Tow ____ Hip ____

      Integrated? some are

      No. of barges? ____ to 8

      Width of tow? 50'

      Length of tow? 111' to 264' (284' EXXON)

      Loaded/unloaded trips? mixed tow but generally empty downstream.

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

1150' long
50' wide
6-8 unit tow

boat is 102' long x 33' wide

1800 HP

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:
  a. You are operating the typical tow previously described.
  b. The river stage is normal, specify stage and current.
  c. Weather clear, daytime, light wind.
  d. Proceed downstream
  e. Describe passage. Circled numbers refer to chart locations.

at 7 come ahead at half speed (5-7 MPH).
at 3 steer to Morgan City side of river.
at 1 must be lined up by now.
at 1 if everything is normal just proceed thru the bridge at same speed.
After passing thru the railroad bridge just steer it around the bend.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Traffic control

Range lights

Upper bridge lights

g. Describe what makes this a difficult/easy passage?

The way the river flows thru these bridges

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids NO
2. wind and current information at bridge NO
3. additional electronic aids NO
4. change in channel NO
5. change in bridge NO
6. other NO

Explain: Vessel Traffic Control is doing a wonderful job. Rail Road span should be back where it was originally.

Case 2 River High (specify)

- How does operation differ from Case 1?
Would do about the same just more tense.

Case 3 Loaded/~~Light~~ (specify)

- How does operation differ from Case 1?

  Would drive it from between 1 and 2 when lined up.

- How does operation differ from Case 2?

  Pretty much the same.

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

NO

GENERAL DATA

- Operating Downstream

  1. How is steering (directional control) affected by:

     a. Going faster than current.

     Best control when you have a steady push.

b. Do you ever go the same speed as current (drifting)? Describe situation.

Only when getting rid of headway directional control is poor.

c. Do you ever go slower than current? Describe situation.

Not normally.
You would only do while flanking to get lined up.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

not very often

3. Describe stopping procedure.

kick her out
let it float
then start backing

4. Assume your tow is out-of-shape i.e., 30^{o} to normal track?

a. Describe actions taken to correct, when loaded and when light.

just steer it out

same for empties but easier

5. What is cause of out-of-shape?

   Some pilots come in a bend with too much headway, they then have to stop and that is when they get out of shape.

6. Why more accidents at night?

   Weak lights on barges and a lack of visibility.

7. Is wind a problem for light tow? loaded tow?

   Yes for light.
   Not much for loaded.

8. Where is pivot point?

   On a loaded tow somewhere between the bow of the boat to the midpoint of the tow.

- Operating Upstream

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

   a. Bridge approach - describe

   From 4+ - 1+ come full ahead all the way.
   at 1 pull back to half head.
   at 2 or 3 go back to full ahead.

   b. Steering and control of tow

   Pretty good steering

   Tow moves slower (steering)

   c. Make-up of tow

   unit tow

   4 - 8 loaded barges

   1150' long

   50' wide

- Have we missed anything important? Do you wish to add anything?

On the GIWW the boats and barges should have lights on them that can be seen for 2 - 3 miles.

PILOT INTERVIEW FORM

SUBJECT # 7 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Berwick Bay

ACTION: Ride Tow________, P to P Interview________, Tel. Interview X

VESSEL NAME and HP: Mary Jayne, 4300 HP Pittsburg to Corpus Cristi, Texas

1. How many years

   a. As a towboat Captain since 1962

   b. How long have you been operating thru this segment of waterway since 1962

2. How did you become a towboat Captain? How did you enter the profession?

   Started with Canal Barge as deck hand and worked way up.

3. What are the worst bridge(s) in your experience?

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 1800 to 5600

      No. of screws? 2

      No. of types of rudders? 2 steering, 4 flanking

   b. Barge:

      Push X Tow ____ Hip ____

      Integrated? yes

      No. of barges? 4 to 8

      Width of tow? 108'

      Length of tow? 1177' overall including towboat

      Loaded/unloaded trips? loaded upstream usually empty downstream

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current.

  c. Weather clear, daytime, light wind.

  d. Proceed downstream

  e. Describe passage. Circled numbers refer to chart locations.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

VTS - very helpful, eliminates traffic problems - small boats, etc.

Visual - bridge structures.

Range lites at night or during poor visibility are helpful.

g. Describe what makes this a difficult/easy passage?

Overloaded tows are biggest problem.

Tugboat too small for barges.

Traffic conjestion before VTS.

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain: Retroflective markers on piers for night passage - would help - (I suggested)

Case 2 River High (specify)

- How does operation differ from Case 1?

  Flank between 2 & 3 if necessary. Otherwise same.

Case 3 Loaded/Light (specify)

- How does operation differ from Case 1?

  Same

- How does operation differ from Case 2?

  Same

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

First RR bridge - upstream with loaded tow hit Morgan city pier - slight damage. Low water, tide running upstream. Inexperienced at time.

GENERAL DATA

- Operating Downstream

  1. How is steering (directional control) affected by:

     a. Going faster than current.

        Yes, to maintain control.

b. Do you ever go the same speed as current (drifting)? Describe situation.
Only when flanking.

c. Do you ever go slower than current? Describe situation.
Never in this area.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?
No

3. Describe stopping procedure.
Reverse - stay straight with current.

4. Assume your tow is out-of-shape i.e., 30° to normal track?
   a. Describe actions taken to correct, when loaded and when light.
   Back & stop - use flanking rudders and current to line up.

5. What is cause of out-of-shape?

6. Why more accidents at night?

   Can't see as well - miss seeing some things at night.
   Bridges well enough lighted.

7. Is wind a problem for light tow? loaded tow?

   Loaded - no problem unless stopped or very high - hurricane.

   Light - real problem - 15 MPH and up.

8. Where is pivot point?

   Center of tow.

- <u>Operating Upstream</u>

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

    a. Bridge approach - describe

    See chart.

    b. Steering and control of tow

    At ① start to line up on RR span

    c. Make-up of tow

    Load and integrated

- Have we missed anything important? Do you wish to add anything?

Channel 13 crowded - all channels, especially in:

New Orleans
St. Louis, Lock 27
Morgan City

Galveston Causeway - bad bridge

PILOT INTERVIEW FORM

SUBJECT # 8 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Berwich Bay

ACTION: Ride Tow________, P to P Interview________, Tel. Interview X

VESSEL NAME and HP: Lea Mae 3200 HP

1. How many years

   a. As a towboat Captain 34 years

   b. How long have you been operating thru this segment of waterway 25 years

2. How did you become a towboat Captain? How did you enter the profession?

   Started out as a deckhand, then moved up to steersman.

3. What are the worst bridge(s) in your experience?

   Greenville & Vicksburg with a heavy tow

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 3200 to 7500

      No. of screws? 2

      No. of types of rudders? 2 steering, 4 flanking

   b. Barge:

      Push X Tow ____ Hip ____

      Integrated? yes

      No. of barges? 5 to 36

      Width of tow? 105' (3 barges)

      Length of tow? 975' (5 barges)

      Loaded/unloaded trips? Southbound loaded (grain)
      Northbound empty
      Towboat 145' long x 35' wide

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

4 or 5 length

1 barge wide

3200 HP

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

<u>Case 1 Normal Environmental Conditions</u>

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current.

  c. Weather clear, daytime, light wind.

  d. Proceed downstream

  e. Describe passage. Circled numbers refer to chart locations.

  At 4 cut back to half speed to cut slide out of her.

  At 3 maneuver to hug Conrad Shipyeard real close then come full ahead.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

range light

highway bridge piers

g. Describe what makes this a difficult/easy passage?

Overloaded boats get in your way piloted by inexperienced operators.

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids No
2. wind and current information at bridge No
3. additional electronic aids No
4. change in channel No
5. change in bridge No
6. other No

Explain:

Case 2 River High (specify)

- How does operation differ from Case 1?

  same way

Case 3 Loaded/Light (specify)

- How does operation differ from Case 1?

  no different

- How does operation differ from Case 2?

  no different

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely). no

GENERAL DATA

- Operating Downstream
  1. How is steering (directional control) affected by:
     a. Going faster than current.

b. Do you ever go the same speed as current (drifting)? Describe situation.

c. Do you ever go slower than current? Describe situation.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

3. Describe stopping procedure.

4. Assume your tow is out-of-shape i.e., 30° to normal track?

   a. Describe actions taken to correct, when loaded and when light.

5. What is cause of out-of-shape?

6. Why more accidents at night?

7. Is wind a problem for light tow? loaded tow?

8. Where is pivot point?

- Operating Upstream

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

   a. Bridge approach - describe

   Between 4 - 1 coming up the lower Atchafalaza you follow the sailing line.
   At 1 you slow down and steer around to get in shape for railroad bridge, then full ahead.

   b. Steering and control of tow

   generally good

   c. Make-up of tow

   same 5 oil barges

- Have we missed anything important? Do you wish to add anything?

  No

PILOT INTERVIEW FORM

SUBJECT # 9.

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Berwick Bay

ACTION: Ride Tow________, P to P Interview________, Tel. Interview X

VESSEL NAME and HP: Susan Lane 4320 HP

1. How many years

   a. As a towboat Captain since 1941

   b. How long have you been operating thru this segment of waterway not too often - 1-2 times since new RR bridge

2. How did you become a towboat Captain? How did you enter the profession?
   Started as deck hand on a pump barge - became Boat Operator - Army in 1943, Transporter corp working in tugs

3. What are the worst bridge(s) in your experience?

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 200 to 5000

      No. of screws? 2

      No. of types of rudders? 2 steering - 4 flanking

   b. Barge:

      Push X Tow ____ Hip ____

      Integrated? both

      No. of barges? ____ to 34 empty upstream, 20 grain barges downstream

      Width of tow? 140' wide, below St. Louis

      Length of tow? 795'

      Loaded/unloaded trips? loaded downstream empty upstream most times

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current.

  c. Weather clear, daytime, light wind.

  d. Proceed downstream

  e. Describe passage. Circled numbers refer to chart locations.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

VTS helpful to broadcast traffic and keep traffic clear

Range helpful

g. Describe what makes this a difficult/easy passage?

Traffic a problem before VTS.

Small towboats with small HP (600 hp) make this a difficult passage.

Wind sometimes a problem.

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain: VTS in use year round. Like to see Algiers "traffic light" operate year round (New Orleans)

Case 2 River High (specify)

- How does operation differ from Case 1?
  Cut point at Conrad Shipyard as close as possible.
  Maybe back and flank to prevent right hand slide with empty barges.

Case 3 [redacted]/Light (specify)

- How does operation differ from Case 1?
  Same

- How does operation differ from Case 2?
  Below RR bridge - with loaded tow you should slow to make bend and back up and flank to head downriver (1100' ton). If empty you can steer around if you have a good steering boat.

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

Crew boats come up in barges at same time - can't stop once committed - ran small boat off to side - VTS has helped this situation.

GENERAL DATA

- Operating Downstream

  1. How is steering (directional control) affected by:

     a. Going faster than current.

        Go faster manually so steering rudders effective

b. Do you ever go the same speed as current (drifting)? Describe situation.
   can't steer

c. Do you ever go slower than current? Describe situation.
   Only when flanking

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?
   Yes - in many places, 4320 HP in high water and still can't stop.

3. Describe stopping procedure.

4. Assume your tow is out-of-shape i.e., 30^{o} to normal track?
   a. Describe actions taken to correct, when loaded and when light.

5. What is cause of out-of-shape?

6. Why more accidents at night?

Can't see as well - many lights in cities confuse operator - many small boats not seen due to background lights.

Radar helpful except near bridges, ½ mile in each side of blocked out.

7. Is wind a problem for light tow? loaded tow?

Loaded - not too much except if stopped.

Light - real problem, especially in canal because tow is strung out longer due to restricted canal width.

8. Where is pivot point?

About the center when empty.

- <u>Operating Upstream</u>

  General discussion regarding bridge passage and upstream operation.

  1. How does upstream operation differ from downstream in regard to:

     a. Bridge approach - describe

        See chart

     b. Steering and control of tow

     c. Make-up of tow

        Loaded

- Have we missed anything important? Do you wish to add anything?

  Channel B too crowded - can't get thru to VTS and important messages - especially at Algiers Point, New Orleans Harbor, Morgan City.

PILOT INTERVIEW FORM

SUBJECT # 10 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Fort Madison, Iowa

ACTION: Ride Tow________, P to P Interview________, Tel. Interview X

VESSEL NAME and HP: Robin 3200 HP

1. How many years

   a. As a towboat Captain 35 years

   b. How long have you been operating thru this segment of waterway 35 years

2. How did you become a towboat Captain? How did you enter the profession?

   His father was a riverman. He became interested and began working on boats at age 8. He worked during summers and evenings, and weekends while in school. At age 15 he was a captain.

3. What are the worst bridge(s) in your experience?

   Greenville, Mississippi - because the channel above the bridge changes so much.

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP ______ to 3200

      No. of screws? Twin (2)

      No. of types of rudders? 2 steering and two flanking

   b. Barge:

      Push X Tow ______ Hip ______

      Integrated? Semi-integrated

      No. of barges? 12 to 16

      Width of tow? 105 ft.

      Length of tow? 780 ft + 140 (boat)

      Loaded/unloaded trips?

      Mississippi River - empty up river
      loaded down river

      Tennessee River - loaded up river
      loaded and empty down river

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

15 jumbos

3 wide (105 ft)

5 long (975 ft)

5000 HP

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current. (1 MPH).

  c. Weather clear, daytime, light wind.

  d. Proceed downstream. Circled numbers refer to chart locations.

Downstream:

Anticipate bridge approach at 8.
Remain at full ahead speed until 4 and then begin to slow down.
Slow to idle with engines in gear at 3. When abreast of Dutchman Island light pull bow to the upper end of the Ft. Madison side sheer fence.
Between 1 and 2 align stern with Dutchman Island light. Go ahead at half speed and proceed thru bridge.

If conditions warrent, this bridge can be flanked by stopping at the draw rest and backing the stern toward Dutchman Island light. Float with current and favor long draw rest on right. As you get in close go half ahead thru the bridge.

There is a right hand draft until you get to the sheer fence then you encounter a strong left hand draft thru the bridge.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

1. Use VHF radio on the bridge
2. As you pass 6 aim the tow at the fall of the hill on the Ft. Madison side (Mile 384.2). This path will bring you 200 ft to the good side of the Dutchman Island Float light.

g. Describe what makes this a difficult/easy passage?

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids -- Shear fence parallel to the long draw nest
2. wind and current information at bridge --current does not change
3. additional electronic aids-- No
4. change in channel--800 yd long dike to straighten current
5. change in bridge--change the position of the draw rest
6. other Yes

Explain: The Coast Guard should abandon their rigid schedule of river maintenance. They should mark the changes in the river bed as the river rises and falls. Pilots should be warned of these changes as they occur.

Case 2 River High (specify)

- How does operation differ from Case 1?

  The current just gets swifter, it does not change direction

  Sometimes you have to cut down to 12 barges maximum

  Basically use the same approach

Case 3 ~~Loaded~~/Light (specify)

- How does operation differ from Case 1?

  No real difference, you just watch the wind more

- How does operation differ from Case 2?

  No change

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

Occurred upstream

The pilot came too close to the Iowa shore.

Interviewee declined to elaborate.

GENERAL DATA

- Operating Downstream

  1. How is steering (directional control) affected by:

     a. Going faster than current.

     It is a requirement to maintain steerage

b. Do you ever go the same speed as current (drifting)? Describe situation.

(Floating)

Sometimes more control over the boat is obtained if one slows to the speed of the current and flanks around.

c. Do you ever go slower than current? Describe situation.

No

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

Many times (it is a fact of the geographical condition of the river)

3. Describe stopping procedure.

a. Pick out a breast mark
b. Back up tow straight with current
c. Stop aligned with the breast

4. Assume your tow is out-of-shape i.e., 30° to normal track?

a. Describe actions taken to correct, when loaded and when light.

Loaded:

Flank into shape by backing into real buoy line and trying the approach again

Empty:

1. Back up and stop
2. Back the stern in the direction you needed to go until you reached a point when you can straighten up and go again.

5. What is cause of out-of-shape?

It is much easier to get out of shape by steering and pushing than it is by flanking and floating.

6. Why more accidents at night?

Limited visibility

7. Is wind a problem for light tow? loaded tow?

Yes, but it is less of a problem for a loaded tow.

8. Where is pivot point?

It varies between vessels.

On the ROBIN it is at the stern of the second barge from the head (350 ft. back).

On the STANTON K. SMITH it is at the stern of the lead barge in the tow (190 ft) (see additional explanation on separate sheet)

LOCATION OF PIVOT POINTS

Pivot points on identifical tows and boats may be located at different locations. This pecularity will occur if either the blade areas of the steering rudders are different or if the maximum allowable rudder angle of each boat is different.

Two nearly identical tow boats that belong to the Arrow Transport Company, the ROBIN and the STANTON K. SMITH display different pivot point locations when pushing identical 16 loaded barge configurations.

The ROBIN is a 140 ft boat with large steering rudders (large blade areas). In a turn the tow is overpowered and the bow immediately goes in the desired direction. The pivot point is approximately at the stern of the second barge from the head (350 ft back from bow of lead barge).

The STANTON K. SMITH is also 140 ft. long and has a propulsion system identical to that of the ROBIN (3200 HP), but the blade areas of its steering rudders are less than those of the ROBIN. When this towboat makes a turn, the bow initially remains almost stationary at a point while the stern does most of the steering by moving around behind the bow and then pushing the tow in the desired direction. The pivot point is consequently at the stern of the lead barge in the tow (190 ft. back).

The location of the pivot point will be influenced by maximum rudder angle. If the ROBIN and the STANTON K. SMITH had steering rudders with identical blade areas, but with maximum rudder deflections of 38 and 45°, the towboat that could deflect its steering rudders the greater amount (45°) would have a pivot point further back from the bow of the lead barge than would the other boat.

- <u>Operating Upstream</u>

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

   a. Bridge approach - describe

   At 2 below the bridge you feel the right hand draft and you are coming full ahead

   b. Steering and control of tow

   Much better

   c. Make-up of tow

   3 wide
   5 long (normal river stage)
   4 long (high water)

- Have we missed anything important? Do you wish to add anything?

PILOT INTERVIEW FORM

SUBJECT # 11 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Ft. Madison

ACTION: Ride Tow ____________, P to P Interview ____________, Tel. Interview x

VESSEL NAME and HP: Col. George Lambert, 4200 HP present assignment

1. How many years

   a. As a towboat Captain 21

   b. How long have you been operating thru this segment of waterway since 1955

2. How did you become a towboat Captain? How did you enter the profession? Father was towboat captain. Started as a deckhand (4 years), mate 3 years.

3. What are the worst bridge(s) in your experience?
Pearl Bridge in Illinois
Mile 280 Louisiana, Missouri (RR bridge)

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 1200 to 4200
      M/V Col. George Lambert data
      No. of screws? 2
      No. of types of rudders? 2 steer and 4 flanking

   b. Barge:

      Push X Tow ____ Hip ____
      Integrated? Non-integrated
      *No. of barges? 12 to 20
      Width of tow? 140'
      Length of tow? 985'
      Loaded/unloaded trips? Loaded South
      Empty North

*Maximum of 15 thru Ft. Madison at 105' wide and 985' long

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

See 4

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

   a. You are operating the typical tow previously described.

   b. The river stage is normal, specify stage and current.

   c. Weather clear, daytime, light wind.

   d. Proceed downstream

   e. Describe passage. Circled numbers refer to chart locations.

Downstream:

At 3 leave sailing line and follow route shown on chart.
Cut back to slow ahead between 2 and 3 during high water.
During normal water conditions no need to slow down but would line up the same.
At 2 pass near buoy shown on chart. Slow ahead during high water.
Between 1 and 2 line up stern mast light on island light. Line up forward mast light on bridge opening and favor starboard pier.
At 1, reverse during high water and use flanking rudders to steer. Maintain slow headway.
At sheerfence head of tow will enter hard left hand draft toward draw rest. Come full ahead and hold on right pier to outrun current. When head clears right hand pier throw hard left rudder to kick stern off draw rest.
It is possible to back up and land on sheer fence but there is danger of breaking up tow. Current will hold tow against fence and fence can be used as a guide to get thru bridge.

e. Describe passage. Circled numbers refer to chart locations. (Continued)

Upstream:

Current deflects off of draw rest toward Ft. Madison shore. This creates a draft toward left ascending shore. Maintain a good speed to outrun this draft. Line up on right side of draw rest and current will set tow toward left.

As tow passes thru bridge current coming down sheer fence tends to set tow down on draw rest. The stern must be kicked to the left to miss draw rest.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Light on end of island-line up stern
Black and red buoys
Line up head on bridge piers
Lights on bridge
Man on head of tow communicates lead barges position to captain - man on each corner of head of tow

g. Describe what makes this a difficult/easy passage?

Left hand draft - current on draw rest

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain:

River areas outside of channel have filled in causing high current, in channel - suggest dredge these areas to reduce current velocity.

Case 2 River High (specify)

- How does operation differ from Case 1?

See case one - includes high water information also

Case 3 Loaded/Light (specify)

- How does operation differ from Case 1?

Same path--easier to stop with empties but cross currents will set you faster.

- How does operation differ from Case 2?

Same as above

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

Partner struck draw rest during downstream passage--no damage to tow or bridge

GENERAL DATA

- Operating Downstream
  1. How is steering (directional control) affected by:
     a. Going faster than current.

     Just need flow from propellors against rudders to steer

b. Do you ever go the same speed as current (drifting)? Describe situation.

Yes, to see what current does to tow.

c. Do you ever go slower than current? Describe situation.

When flanking above bridge loaded. To slow down prior to passing thru bridge.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

Many years ago with low HP tows.

3. Describe stopping procedure.

4. Assume your tow is out-of-shape i.e., 30° to normal track?

a. Describe actions taken to correct, when loaded and when light.

Try to stop tow
Back stern over to realign until back in shape
Work stern back into place and let bow fall into right position
Same for light or loaded--easier if light can do it all quicker, can stop easier.

5. What is cause of out-of-shape?

6. Why more accidents at night?

Everything visible during day. Must search out points with search light at night---easy to misjudge amount of set at night.

7. Is wind a problem for light tow? loaded tow?

No problem to loaded tow.
Problem to light 10-12 MPH wind

8. Where is pivot point?

About second barge out

- <u>Operating Upstream</u>

  General discussion regarding bridge passage and upstream operation.

  1. How does upstream operation differ from downstream in regard to:

     a. Bridge approach - describe

     b. Steering and control of tow

     c. Make-up of tow

- Have we missed anything important? Do you wish to add anything?

No

PILOT INTERVIEW FORM

SUBJECT # 12 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Fort Madison

ACTION: Ride Tow______, P to P Interview______, Tel. Interview X

VESSEL NAME and HP: LEA MAE 3200 HP

1. How many years

   a. As a towboat Captain 34 years

   b. How long have you been operating thru this segment of waterway 25 years

2. How did you become a towboat Captain? How did you enter the profession?

   Started out as deckhand then a steersman

3. What are the worst bridge(s) in your experience?

   Greenvill and Vicksburg with a heavy tow

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 3200 to 7500

      No. of screws? 2

      No. of types of rudders? 2 steering 4 flanking

   b. Barge:

      Push X Tow ______ Hip ______

      Integrated? Yes

      No. of barges? 5 to 36

      Width of tow? 105 feet (3 barges)

      Length of tow? 975 ft. (5 barges)

      Loaded/unloaded trips? Southbound loaded grain

      Northbound unloaded

   boat 145' long

   35' wide

   normally mixed

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

5 long - 975 ft.

3 wide - 103 ft.

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current.

  c. Weather clear, daytime, light wind.

  d. Proceed downstream

  e. Describe passage. Circled numbers refer to chart locations.

Downstream:

Begin to anticipate bridge approach at 6 on chart.
Reduce speed at 3 to half ahead and line up on bridge piers.
Steer to port at 1 to offset right hand draft.
At bridge steer to starboard and proceed full speed to out run left hand draft.

There is a right hand set until about 500' above the bridge. Expect a left hand set thru bridge.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Check for northbound traffic on radio.

g. Describe what makes this a difficult/easy passage?

Current hitting the bank then changes direction above bridge.

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids - Yes
2. wind and current information at bridge - No
3. additional electronic aids - No
4. change in channel - No
5. change in bridge - No
6. other

Explain:

Range light below the bridge below 3 on the Iowa shore (bright lights)

Dike between 1 and 2 (halfway between) from Iowa shore

Case 2 River High (specify)

- How does operation differ from Case 1?

At 3 steer hard to port (10-15°) to fight the set

Case 3 Loaded/Light (specify)

- How does operation differ from Case 1?

  Stay on the sailing line

- How does operation differ from Case 2?

  Pretty much the same

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

No

GENERAL DATA

- Operating Downstream
  1. How is steering (directional control) affected by:
     a. Going faster than current.

        Best control

b. Do you ever go the same speed as current (drifting)? Describe situation.

Only when you flanking around a bend

c. Do you ever go slower than current? Describe situation.

No

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

Yes, in narrow places in the river

3. Describe stopping procedure.

Slow down, then reverse engines

4. Assume your tow is out-of-shape i.e., 30^{o} to normal track?

a. Describe actions taken to correct, when loaded and when light.

Loaded: Back into current and let it throw your bow around

Light: Steer out of it

5. What is cause of out-of-shape?

Lack of visibility when you need to line up tow with bridge piers.

6. Why more accidents at night?

Poorer judgment at night
Lack of visibility

7. Is wind a problem for light tow? loaded tow?

Yes for light tow.

Not too much for loaded tow.

8. Where is pivot point?

Middle of tow (when steering)

- <u>Operating Upstream</u>

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

   a. Bridge approach - describe

   No problem
   Come in high on port side (20^{0} angle)

   b. Steering and control of tow

   Much better

   c. Make-up of tow

      15 barges (empty)

- Have we missed anything important? Do you wish to add anything?

Coast Guard should keep the buoys maintained on the dikes.

A lot of boats are overloaded (too much tonnage for boat's horsepower)

PILOT INTERVIEW FORM

SUBJECT # 13.

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Decatur, Alabama

ACTION: Ride Tow______, P to P Interview ✓, Tel. Interview______

VESSEL NAME and HP: R. E. Bridges 1400 HP

1. How many years

   a. As a towboat Captain Since 1969

   b. How long have you been operating thru this segment of waterway Since 1962

2. How did you become a towboat Captain? How did you enter the profession?

   He started as an engineer and then began training under a Captain.

3. What are the worst bridge(s) in your experience?

   Illinois Central Railroad Bridge.

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 1000 to 6600 HP

      No. of screws? 2

      No. of types of rudders? 2 steering, 4 flanking

   b. Barge:

      Push ✓ Tow ______ Hip ______

      Integrated? Yes

      No. of barges? 4 to 40

      Width of tow? 105' -3 barges

      Length of tow? 975' -5 barges

      Loaded/unloaded trips? Empty upstream
      Loaded or mixed downstream.

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

105' wide
975' long
1400 HP
Boat
108' long
25' wide

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

a. You are operating the typical tow previously described.

b. The river stage is normal, specify stage and current.

c. Weather clear, daytime, light wind.

d. Proceed downstream

Downstream:

Anticipate approach to bridge at 5 and cut back to ¼ ahead. Hold course on the sailing line and let headway run out. At 2 come ahead to ½ speed.

If it looks right, come ahead full and steer to port. Slow to half ahead and line up with shoreline approaching other railroad bridge.

At 1 come full ahead and pass thru bridge.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Radio to bridge.

g. Describe what makes this a difficult/easy passage?

Human factor or nature can cuase problems.

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain:
Replacing the swing bridge with a lift span.

Case 2 River High (specify)

- How does operation differ from Case 1?

  More current, not as much control of boat and tow, same path, running a little slower.

Case 3 ~~Loaded~~/Light (specify)

- How does operation differ from Case 1?

  With empties wait until 3 to slow down, watch for wind with empties.

- How does operation differ from Case 2?
  Just slow down a little more, same path.

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

No.

GENERAL DATA

- Operating Downstream

  1. How is steering (directional control) affected by:

     a. Going faster than current.

        Better control is gained by going faster than the current.

b. Do you ever go the same speed as current (drifting)? Describe situation.

Sometimes when you are biding your time while another boat gets out of your way.

c. Do you ever go slower than current? Describe situation.

Only when you are trying to lengthen the distance between you and another towboat.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

Yes, during high river stages and in center of narrow channels during extreme low water.

3. Describe stopping procedure.

Knock engines out, float for awhile, then reverse engines slowly and then according to speed and destination.

4. Assume your tow is out-of-shape i.e., 30^{0} to normal track?

a. Describe actions taken to correct, when loaded and when light.

Loaded:

Try to get in a flanked position, knock engines out and float letting current do the rest.

Empties:

For large tow, I would do the same for small tow, just drive it on out.

5. What is cause of out-of-shape?
Current change.

6. Why more accidents at night?
You can't see the shore lines as good as in the daylight.

7. Is wind a problem for light tow? loaded tow?
Yes - light
No - loaded

8. Where is pivot point?

- <u>Operating Upstream</u>

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

   a. Bridge approach - describe

      Call the bridge. You wouldn't even have to slow down.

   b. Steering and control of tow

      You have a lot better control.

   c. Make-up of tow

      Yes, the same.

- Have we missed anything important? Do you wish to add anything?

No.

PILOT INTERVIEW FORM

SUBJECT # 14 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Decatur, Alabama

ACTION: Ride Tow________, P to P Interview X , Tel. Interview______

VESSEL NAME and HP: Frank Alter 760 HP

1. How many years

   a. As a towboat Captain 10 in office ~~3 as Pilot~~ 8½ years

   b. How long have you been operating thru this segment of waterway 5 years

2. How did you become a towboat Captain? How did you enter the profession?

   He started as a deckhand in 1947. He worked his way up swiftly. Missed only 2½ years due to USAF and shore job.

3. What are the worst bridge(s) in your experience?

   Pearl on Illinois River
   Fort Madison, Iowa
   Hannibal Railroad, Missouri

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 400 to 6650

      No. of screws? 1, 2 and 3

      No. of types of rudders? 1 - 2 - 3 steering
      2 - 4 - 6 flanking

   b. Barge:

      Push X Tow ______ Hip ______

      Integrated? 4 and 8 unit

      No. of barges? 1 to 62

      Width of tow? 50' to 360'

      Length of tow? 195' to 1550'

      Loaded/unloaded trips? Both
      Downstream loaded with coal
      Upstream loaded with grain

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

760 HP
590' long
105' wide
boat 140' long
27' wide

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

a. You are operating the typical tow previously described.

b. The river stage is normal, specify stage and current.

c. Weather clear, daytime, light wind.

d. Proceed downstream

e. Describe passage. Circled numbers refer to chart locations.

Downstream:

Follow sailing line until you sight bridge at about 5 or 6. Cut back to ¼ ahead. Start bridge procedure at 5 at night while on radar. Align with bridge at 3 - 4. At mile 306 go more to port to line up. From 2 - 1 after lining up go full ahead. Under bridge reduce speed to ¼ ahead. Thru bridge rejoin the sailing line and come back to full ahead.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Visual sighting of the bridge
Radar
Call the bridge

g. Describe what makes this a difficult/easy passage?

There are many lights in the city that tend to blind you.

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids NO
2. wind and current information at bridge NO
3. additional electronic aids NO
4. change in channel NO
5. change in bridge Make railroad bridge a lift span
6. other NO

Explain:

Keep the lights on the bridges bright and burning.

Case 2 River High (specify)

- How does operation differ from Case 1?

High water with loaded tow would be done the same way. Path would be the same.

Case 3 ~~Loaded~~/Light (specify)

- How does operation differ from Case 1?
  SAME

- How does operation differ from Case 2?

  SAME

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

NO

GENERAL DATA

- Operating Downstream

  1. How is steering (directional control) affected by:

     a. Going faster than current.

        More control because you are going faster than the set.

b. Do you ever go the same speed as current (drifting)? Describe situation.

Sometimes when you have a large tow and a small boat.

c. Do you ever go slower than current? Describe situation.

Only if you are holding up waiting for another boat to get out of a tight spot.

When you are backing to make a landing or flanking you let the current aid you in keeping you lined up.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

Yes, in some places but a Captain can always find a point on the bank where slack water can be found.

3. Describe stopping procedure.

Bring engines back to dead stop; let it float for 3 or 4 tow lengths back slow astern to let the wheel wash go under the boat and then gradually increase speed till full astern.

4. Assume your tow is out-of-shape i.e., 30° to normal track?

a. Describe actions taken to correct, when loaded and when light.

Loaded:
You immediately flank and hold the head of your tow out to the bend and let cross current straighten you out. Hold the stern near the bar (Greenville, Mississippi).

Light:
Do the same if the wind was no problem.

5. What is cause of out-of-shape?

Tow can get in a situation that you don't know about till you get there.

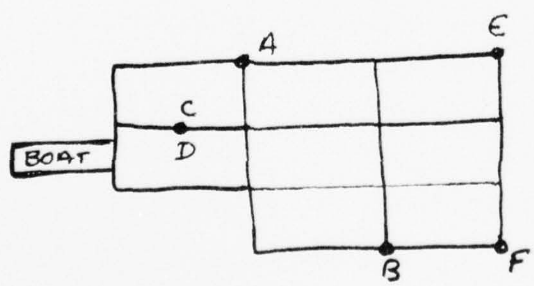
6. Why more accidents at night?

Lack of visibility
Lights out
Can't always see shoreline.

7. Is wind a problem for light tow? loaded tow?

Yes, for empty barges.
It doesn't bother a loaded tow.

8. Where is pivot point?



A. Loaded port rakes
B. Loaded starboard
C. Unloaded port
D. Unloaded starboard
E. Loaded without rakes

- <u>Operating Upstream</u>

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

    a. Bridge approach - describe

        Come up the sailing line.
        Come full ahead.

    b. Steering and control of tow

        Good control.

    c. Make-up of tow

        Identical.

- Have we missed anything important? Do you wish to add anything?

  The railroad swing bridge should be replaced by a lift span.

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ANALYSIS OF BRIDGE COLLISION INCIDENTS. VOLUME II.(U)
DEC 76 R B DAYTON DOT-CG-31446-A
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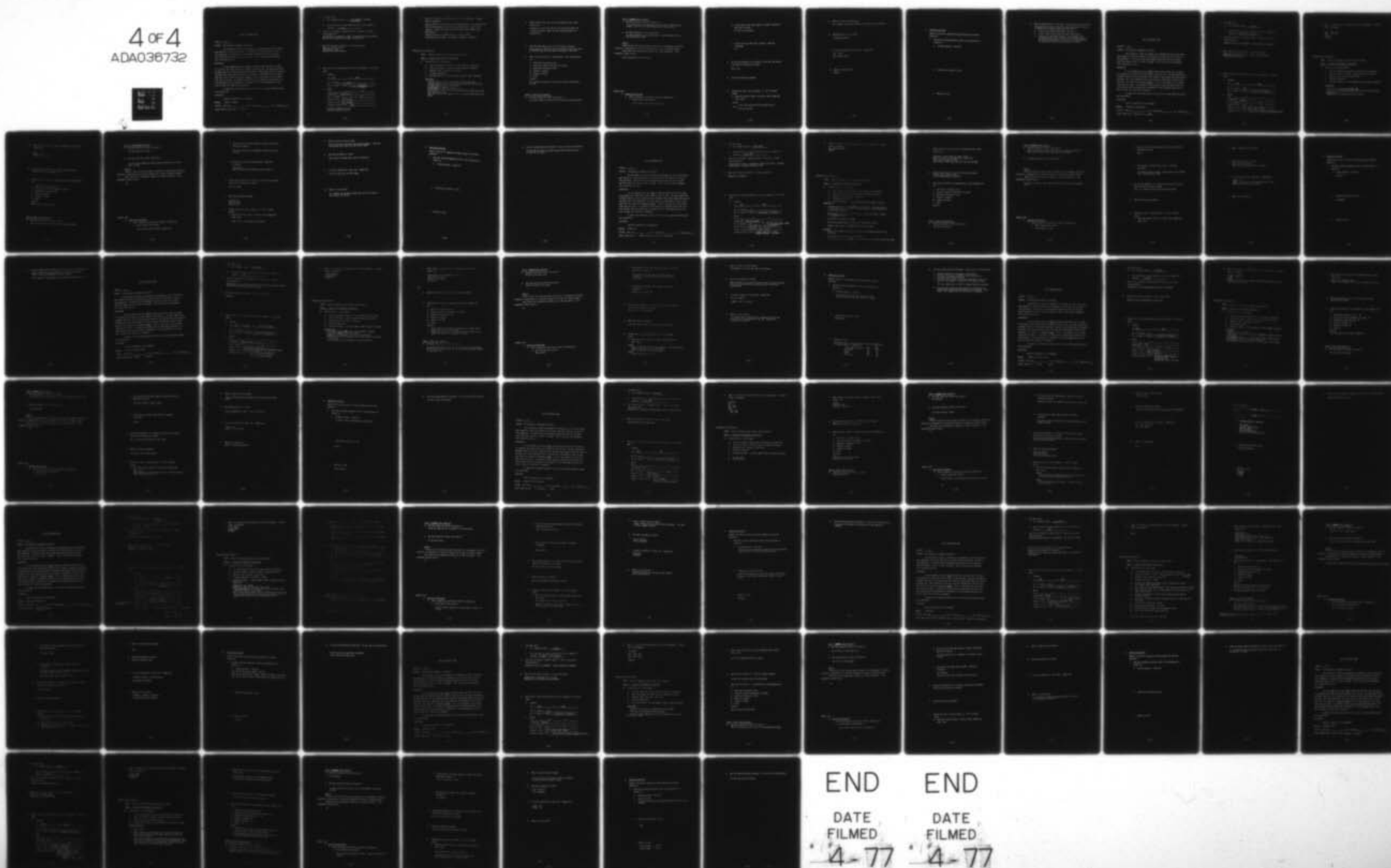

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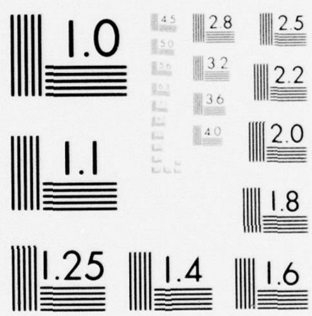
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PILOT INTERVIEW FORM

SUBJECT # 15 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Decatur, Alabama

ACTION: Ride Tow________, P to P Interview________, Tel. Interview X

VESSEL NAME and HP: Robin 3200HP

1. How many years

   a. As a towboat Captain 10 in Office / 3 as Pilot 8½ years

   b. How long have you been operating thru this segment of waterway 5 years

2. How did you become a towboat Captain? How did you enter the profession?

   He started as a deckhand in 1947. He worked his way up swiftly.
   Missed only 2½ years due to USAF and shore job.

3. What are the worst bridge(s) in your experience?

   Pearl on Illinois River
   Fort Madison, Iowa
   Hannibal Railroad, Missouri

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 400 to 6650

      No. of screws? 1, 2 and 3

      No. of types of rudders? 1 - 2 - 3 steering / 2 - 4 - 6 flanking

   b. Barge:

      Push ______ Tow ______ Hip ______

      Integrated? 4 and 8 unit

      No. of barges? 1 to 62

      Width of tow? 59' to 360'

      Length of tow? 195' to 1550'

      Loaded/unloaded trips? both

      Downstream loaded with caol
      Upstream loaded with grain

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

Barge traffic on this portion of the Tennessee River is so diversified that no configuration can really be called typical. But for our company, a normal tow could consists of 15-24 jumbo barges with 3200-5000 HP.

Maximum Upstream 24 loaded barges (8 long x 3 wide)

Configuration downstream 23 barges (21 loaded, 2 empties)

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current.

  c. Weather clear, daytime, light wind.

  d. Proceed downstream

  e. Describe passage. Circled numbers refer to chart locations.

Downstream:

At 6 cut speed to about ¼ ahead and follow sailing line.
From 6 to 5 head the tow slightly to the left and line up stern with the channel side of the towhead.
From 4 to 3 let headway run out.
Between 1 and bridge slow down some more.
When head of tow thru the bridge stop engines and back tow to the left descending shore.
When tow lined up with channel span of railroad bridge curve full ahead.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Presently, he uses the radio on the railroad bridge, the transmission tower light, and the towhead between mile 306 and 307.

g. Describe what makes this a difficult/easy passage?

This passage is difficult due to the width of the swing span of the RR bridge and the constant presence of the wind.

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain:

The proposed horizontal lift span for the RR bridge would be nice.

Case 2 River High (specify)

- How does operation differ from Case 1?

On the RR bridge you would go thru the shore side swing span

Case 3 ~~Loaded~~/Light (specify)

- How does operation differ from Case 1?

  If you were light, you would have to watch out for the wind more closely. The wind from the NW deserves the most caution.

- How does operation differ from Case 2?

  You would probably use the harbor boat to guide the bow of your tow through the bridges.

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

Never experienced real difficulty.

GENERAL DATA

- Operating Downstream

  1. How is steering (directional control) affected by:

     a. Going faster than current.

        It is required to maintain steerage.

b. Do you ever go the same speed as current (drifting)? Describe situation.

At times when flanking.

c. Do you ever go slower than current? Describe situation.

No.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

Many times.

3. Describe stopping procedure.

4. Assume your tow is out-of-shape i.e., 30° to normal track?

a. Describe actions taken to correct, when loaded and when light.

Loaded:
Flank into shape and start approach again.

Light:
Back up and stop.

5. What is cause of out-of-shape?

It is easier to get out-of-shape by steering than by flanking.

6. Why more accidents at night?

Limited visibility.

7. Is wind a problem for light tow? loaded tow?

Yes - light

Not so much loaded.

8. Where is pivot point?

Varies.

- <u>Operating Upstream</u>

  General discussion regarding bridge passage and upstream operation.

  1. How does upstream operation differ from downstream in regard to:

     a. Bridge approach - describe

     b. Steering and control of tow

     c. Make-up of tow

- Have we missed anything important? Do you wish to add anything?

  Since getting in shape for the RR bridge and staying in shape is a problem, the following suggestions were made:

  - Install the proposed horizontal lift span or,
  - build a shear fence around the open swing span or,
  - instruct the RR bridge tenders to aid towboat pilots having difficulty (e.g. in high winds) by being prepared to rotate the swing span slightly, as the tow passes by, to give the pilot more room to maneuver his tow.

PILOT INTERVIEW FORM

SUBJECT # 16.

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Greenville, Mississippi

ACTION: Ride Tow________, P to P Interview________, Tel. Interview X

VESSEL NAME and HP: Marilyn M. II, 1800HP

1. How many years

   a. As a towboat Captain 15 years

   b. How long have you been operating thru this segment of waterway 22 years, 15 captain

2. How did you become a towboat Captain? How did you enter the profession?

   Worked his way up as deckhand. Helped captain by steering.

3. What are the worst bridge(s) in your experience?

   Morgan City is bad when river is high. Greenville and Vicksburg are treacherous.

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 1800 to 3200

      No. of screws? Twin

      No. of types of rudders? 2 steering, 4 flanking

   b. Barge:

      Push X Tow ____ Hip ____

      Integrated? Some are

      No. of barges? ____ to 8

      Width of tow? 50'

      Length of tow? 111' to 264' (284' EXXON)

      Loaded/unloaded trips? Mixed tow but generally empty downstream.

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

660' - 800' long
100' - 150' wide
1800HP
11 Barges

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current.

  c. Weather clear, daytime, light wind.

  d. Proceed downstream

  e. Describe passage. Circled numbers refer to chart locations.

Downstream:

Kill off all headway between 5 and 6.
Float all the way around the bend and line up the tow with the bridge braces.
At 1 come full ahead and drive thru bridge.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Radio
Lights on the bridge

g. Describe what makes this a difficult/easy passage?
Tendency to fall into bend too far.

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain:
Nothing that he can think of.

Case 2 River High (specify)

- How does operation differ from Case 1?

You can cut the point some more right around the dikes.

Case 3 Loaded/~~Light~~ (specify)

- How does operation differ from Case 1?

  You would have less slide.

- How does operation differ from Case 2?

  Just kill your headway and come around the bend with a little push (½ head).

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

NO.

GENERAL DATA

- Operating Downstream

  1. How is steering (directional control) affected by:

     a. Going faster than current.

        Best control when you have a steady push.

b. Do you ever go the same speed as current (drifting)? Describe situation.

Only when getting rid of headway, directional control is poor.

c. Do you ever go slower than current? Describe situation.

Not normally.
Would only occur when flanking to get lined up.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

Not very often.

3. Describe stopping procedure.

Kick her out.
Let her float.
Start backing.

4. Assume your tow is out-of-shape i.e., 30° to normal track?

a. Describe actions taken to correct, when loaded and when light.

Steer it out. With empties its easier.

5. What is cause of out-of-shape?

Some pilots come into bend with too much headway. They have to stop and that's when they get out of shape.

6. Why more accidents at night?

Weak lights on barges and a lack of visibility.

7. Is wind a problem for light tow? loaded tow?

Yes, for light tow, not for loaded.

8. Where is pivot point?

On a loaded tow somewhere between the tow of the boat to the midpoint of the tow.

- <u>Operating Upstream</u>

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

   a. Bridge approach - describe

   b. Steering and control of tow

   c. Make-up of tow

- Have we missed anything important? Do you wish to add anything?

  On the GIWW the boats and barges should have lights that can be seen for 2-3 miles.

PILOT INTERVIEW FORM

SUBJECT # 17.

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Greenville

ACTION: Ride Tow______, P to P Interview______, Tel. Interview X

VESSEL NAME and HP: Leader, Forwarder, Courier, 5000HP each

1. How many years

   a. As a towboat Captain Since 1941

   b. How long have you been operating thru this segment of waterway Since 1944

2. How did you become a towboat Captain? How did you enter the profession?

   Uncle worked on river - started out after high school - started as deck hand. Started piloting in 1941.

3. What are the worst bridge(s) in your experience?

   Greenville, Vicksburg

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 1200 to 5000

      No. of screws? 2

      No. of types of rudders? 2 steering, 4 flanking

   b. Barge:

      Push X Tow ____ Hip ____

      Integrated? Semi-integrated

      No. of barges? 13 to 49 (24 with present 5000HP towboats)

      Width of tow? 8 wide 280' max., 140' min.

      Length of tow? 5 long 975' normal length

      Loaded/unloaded trips? Loaded, downriver - steel
      Loaded, upriver - iron ore

5. What is a typical tow configuration for this waterway? (length, width, horsepower)
975' long 24 barges
5000HP

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current.

  c. Weather clear, daytime, light wind.

  d. Proceed downstream

  e. Describe passage. Circled numbers refer to chart locations.

Downstream:

Slow down about a mile above 7 during high water. Low water passage is out toward center of river - no need to cut in close to dikes as in high water passage.

During high water, stay close to inside of bend and edge of sandbar between 6 and bridge.

Be careful of slide at about 4.

Bend between 4 and 1 can be flanked if conditions warrant.

Maintain slow speed up to 4 and then drive to bridge.

Upstream:
Cross river at 3 to make passage up the right ascending shore during high water.

Hold close to shore right up thru bridge.

"'ove bridge pass over sandbar just off the end of the dikes between 1 and 4.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Need buoys above bridge to judge "slide".
Need 4-5 buoys to work edge of bar (see chart).
Need range at Anconia Point.
Need another light above Vaucluse light at about 4.

g. Describe what makes this a difficult/easy passage?
Bridge right at end of bend.
Slide in bend makes it difficult.

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain:

Case 2 River High (specify)

- How does operation differ from Case 1?

See chart and case 1.

Case 3 -~~Loaded~~/Light (specify)

- How does operation differ from Case 1?

  Same - except hold center of bridge span instead of left pier. Empty tow can push out of slide easier than loaded.

- How does operation differ from Case 2?

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

No troube - may over steer toward left pier at times but corrected in time.

GENERAL DATA

- Operating Downstream

  1. How is steering (directional control) affected by:

     a. Going faster than current.

        Need headway to steer.

b. Do you ever go the same speed as current (drifting)? Describe situation.

   Never.

c. Do you ever go slower than current? Describe situation.

   Use flanking buoy at night. Walker Bend can be flanked but is not done very often.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?
   Yes, in a number of places low HP and overloaded.

3. Describe stopping procedure.

4. Assume your tow is out-of-shape i.e., 30^{0} to normal track?
   a. Describe actions taken to correct, when loaded and when light.

5. What is cause of out-of-shape?

6. Why more accidents at night?

   Can't tell if sliding.
   Can't tell speed in relation to current.

7. Is wind a problem for light tow? loaded tow?

   Loaded - no
   Empty - yes - hard to flank an empty tow in wind.
   15MPH wind begins to be a problem.

8. Where is pivot point?

- <u>Operating Upstream</u>

  General discussion regarding bridge passage and upstream operation.

  1. How does upstream operation differ from downstream in regard to:

     a. Bridge approach - describe

        See chart.

     b. Steering and control of tow

        No problem.

     c. Make-up of tow

- Have we missed anything important? Do you wish to add anything?

  White reflectors on black buoys show up better in fog than green - Coast Guard changed all white to green.

  Many suggestions submitted to Coast Guard but nothing ever done.

PILOT INTERVIEW FORM

SUBJECT # 18 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Greenville, Mississippi

ACTION: Ride Tow________, P to P Interview________, Tel. Interview X

VESSEL NAME and HP: Argonaut 10,500HP

1. How many years

   a. As a towboat Captain Since 1949

   b. How long have you been operating thru this segment of waterway Same

2. How did you become a towboat Captain? How did you enter the profession?

   Worked way up since school; galley boy for two months, then deckhand and finally steersman taught by a Captain.

3. What are the worst bridge(s) in your experience?

   Vicksburg

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 6400 (2 screws) to 10,500 (3 screws)

      No. of screws? 3

      No. of types of rudders? 2 steering, 4 flanking

   b. Barge:

      Push X Tow ____ Hip ____

      Integrated? Semi-not always a match

      No. of barges? ____ to 43

      Width of tow? 7-8 wide (245 - 280 ft)

      Length of tow? 5 long (975 ft) maximum safe length for loaded tow

      Loaded/unloaded trips? 25 of 43 loaded downstream

      49 of 54 loaded upstream

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

5 long (975 ft)
8 wide (280ft)
10,500HP

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:
  - a. You are operating the typical tow previously described.
  - b. The river stage is normal, specify stage and current.
  - c. Weather clear, daytime, light wind.
  - d. Proceed downstream
  - e. Describe passage. Circled numbers refer to chart locations.

Downstream:
Slow at 5 so that by 4 you are running about 1/3 ahead.
Going slow at 4 bow will swing about.
At 3 come full ahead and line up on left hand pier.
When 2000 feet from bridge pull back to the right to avoid the slack water.
At this point you will encounter a right hand draft.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Radio monitor 16 (northbound traffic).
Vaucluse bend light.
Lights on the bridge.
Red buoys.

g. Describe what makes this a difficult/easy passage?

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain:

1. The Vaucluse light should be replaced by a strong steady green light with a flasher below.
2. Reflective tape should be added next to the lights on the Greenville bridge (18" long and 12" wide).

Case 2 River High (specify)

- How does operation differ from Case 1?

You would come down over the top of the sandbar along the edge of the first two dikes, head for the Arkansas pier while fighting a right hand draft.

Case 3 ~~Loaded~~/Light (specify)

- How does operation differ from Case 1?
  Watch for wind and slide.

- How does operation differ from Case 2?
  Same for either river stage.

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

NO

GENERAL DATA

- Operating Downstream
  1. How is steering (directional control) affected by:
     a. Going faster than current.
        More control.

b. Do you ever go the same speed as current (drifting)? Describe situation.

Not normally, but once when my steering went out, I steered by reversing one screw and drifted thru the bridge.

c. Do you ever go slower than current? Describe situation.

Makes it real difficult.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

Yes, but it is not customary.

3. Describe stopping procedure.

Slow down, drift awhile, back slow then full astern.

4. Assume your tow is out-of-shape i.e., 30^{o} to normal track?

a. Describe actions taken to correct, when loaded and when light.

Loaded:
Flank if possible (not too much headway). The best flanking speed is the same speed as the current.
Then full ahead on a straight rudder.

Light:
Throw a wind flank into it.

5. What is cause of out-of-shape?

Misjudgement of current and lack of experience.

6. Why more accidents at night?

Most accidents occur within 30 minutes after the watch changes, pilots are just getting up and they are too relaxed and overconfident.

7. Is wind a problem for light tow? loaded tow?

Yes, for empties.

Loaded: only in a storm.

8. Where is pivot point?

It is where most of the weight is somewhere from the bow of the boat to the midpoint of the tow. Empties are normally put up front.

- Operating Upstream

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

   a. Bridge approach - describe

      It is easier, just go under the green light. Head up on green light and proceed full ahead.

   b. Steering and control of tow

      Much better.

   c. Make-up of tow

      You cannot take as many up as down, normally take 7 long (including some ½'s) and 8 wide).

Barge Data (General):	Long	Wide
LY(½ jumbo)	100'	35'
½barge	61'	32'
jumbo	195'	35'
long jumbo	200'	35'

- Have we missed anything important? Do you wish to add anything?

1. Bridges shouldn't be navigated in bad weather.
2. The Coast Guard does a wonderful job of helping the riverman in the Greenville area.
3. The Coast Guard should require more experience of men who apply for an operator's liscense for the Western Rivers.

   For long, heavy tows, a Pilot's liscense should be required.

4. There should be some defined program for young people to become pilots other than the National River Academy. Young people can't support their families while at Academy.

PILOT INTERVIEW FORM

SUBJECT # 19 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Greenville, Mississippi

ACTION: Ride Tow________, P to P Interview________, Tel. Interview X

VESSEL NAME and HP: LEA MAE 3200HP

1. How many years

   a. As a towboat Captain 34 years

   b. How long have you been operating thru this segment of waterway 25 years

2. How did you become a towboat Captain? How did you enter the profession?

   Started out as a deckhand then moved up to steersman.

3. What are the worst bridge(s) in your experience?

   Greenville and Vicksburg with a heavy tow.

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 3200 to 7500

      No. of screws? 2

      No. of types of rudders? 2 steering, 4 flanking

   b. Barge:

      Push X Tow ____ Hip ____

      Integrated? Yes

      No. of barges? 5 to 36

      Width of tow? 105' (3 barges)

      Length of tow? 975' (5 barges)

      Loaded/unloaded trips? Southbound loaded (grain)
      Northbound empty.
      Towboat 145' long x 35' wide

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

5 long (975 ft)
3 wide (105 ft)
3200HP
Sometimes string empty oil barges along the outside (across the head and down one side).

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

a. You are operating the typical tow previously described.

b. The river stage is normal, specify stage and current.

c. Weather clear, daytime, light wind.

d. Proceed downstream

e. Describe passage. Circled numbers refer to chart locations.

Downstream:

At 5 cut back to ¼ speed.
Come an easy distance off the buoys at 3 and let stern fall off to starboard.
Between 2 and 1 steer to left descending shore (steer back on buoy line) and drive full ahead on the buoys.
Between 1 and bridge steer back on green lights on the bridge.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Check for northbound traffic.
Steady up on Vaucluse Point light when sandbar lets you.

g. Describe what makes this a difficult/easy passage?
Bend above the bridge.

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids NO
2. wind and current information at bridge NO
3. additional electronic aids NO
4. change in channel NO
5. change in bridge NO
6. other NO

Explain:
Possibly keeping the sandbar dredged off.

Case 2 River High (specify)

- How does operation differ from Case 1?

You can come over sandbar.

Case 3 ~~Loaded~~/Light (specify)

- How does operation differ from Case 1?

  Not a whole lot of difference, you can swing empties around easier.

- How does operation differ from Case 2?

  About the same.

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

NO

GENERAL DATA

- Operating Downstream

  1. How is steering (directional control) affected by:

     a. Going faster than current.

        Best control.

b. Do you ever go the same speed as current (drifting)? Describe situation.

Only when flanking around a bend.

c. Do you ever go slower than current? Describe situation.

Never.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

Yes, in some narrow sections of the river.

3. Describe stopping procedure.

Slow down, then reverse engines.

4. Assume your tow is out-of-shape i.e., 30° to normal track?

a. Describe actions taken to correct, when loaded and when light.
When loaded back into current and let it throw bow around.
When light steer out of it.

5. What is cause of out-of-shape?

Lack of visibility when you have to line up tow with bridges piers.

6. Why more accidents at night?

Poorer judgement at night. Lack of visibility.

7. Is wind a problem for light tow? loaded tow?

Light - yes
Loaded - not too much.

8. Where is pivot point?

Middle of tow when steering.

- <u>Operating Upstream</u>

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

   a. Bridge approach - describe

      No sweat, come up straight upon the bridge.

   b. Steering and control of tow

      Better.

   c. Make-up of tow

      Same 15 buoys.

- Have we missed anything important? Do you wish to add anything?

  The bar is the main problem.

PILOT INTERVIEW FORM

SUBJECT # 20.

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Greenville, Mississippi

ACTION: Ride Tow________, P to P Interview X, Tel. Interview______

VESSEL NAME and HP: F. R. Bigolow 6600HP

1. How many years

   a. As a towboat Captain Since 1969

   b. How long have you been operating thru this segment of waterway Since 1962

2. How did you become a towboat Captain? How did you enter the profession?
   Started as an engineer and later began training under Captain.

3. What are the worst bridge(s) in your experience?
   Illinois Central Railroad Bridge

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 1000 to 6600

      No. of screws? 2

      No. of types of rudders? 2 steering, 4 flanking

   b. Barge:

      Push X Tow ______ Hip ______

      Integrated? Yes

      No. of barges? 4 to 40

      Width of tow? 105-3 barges

      Length of tow? 975 - 5 barges

      Loaded/unloaded trips? Empty upstream
      Loaded or mixed downstream

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

25 barges
5x5
975' long
175' wide
boat
166' long
45' wide

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current.

  c. Weather clear, daytime, light wind.

  d. Proceed downstream

  e. Describe passage. Circled numbers refer to chart locations.

a. At upper dike.
b. You slow down.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Visual
Vaucluse light
String of red buoys

g. Describe what makes this a difficult/easy passage?
Sometimes the sand bar builds up.

h. What would be helpful in guaranteeing a safe passage such as:

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain:

Keep the bar above the bridge.
Dreged out in low water.

Case 2 River High (specify)

- How does operation differ from Case 1?
Come over the bar.

Case 3 ~~Loaded~~/Light (specify)

- How does operation differ from Case 1?

  No different.

- How does operation differ from Case 2?

  Use same high water route.

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

No.

GENERAL DATA

- Operating Downstream
  1. How is steering (directional control) affected by:
     a. Going faster than current.

        Better control is gained by going faster than current.

b. Do you ever go the same speed as current (drifting)? Describe situation.

   Sometimes waiting for another boat to get out of your way.

c. Do you ever go slower than current? Describe situation.

   Only when trying to lengthen the distance between you and another towboat.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

   Yes, during high river stages and in center of narrow channels during extreme low water.

3. Describe stopping procedure.

   Knock engines out.
   Float for awhile.
   Then reverse engines slowly.

4. Assume your tow is out-of-shape i.e., 30^{o} to normal track?

   a. Describe actions taken to correct, when loaded and when light.

      Loaded:
         Try to get into a flanking position knock engines out and float letting current do the rest.

      Empties:
         For large tow do same as above. For small tow just drive it on out.

5. What is cause of out-of-shape?

   Current change.

6. Why more accidents at night?

   You can't see the shore lines as good as in the daylight.

7. Is wind a problem for light tow? loaded tow?

   Yes - for light tow.
   No - for loaded.

8. Where is pivot point?

   N/A

D Operating Upstream

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

a. Bridge approach - describe

Full ahead.
Use main channel span.
Normally empty.
Favor Arkansas pier.
Generally follow sailing line.

b. Steering and control of tow

Very good response.

c. Make-up of tow

30 barges
6 long
5 wide

- Have we missed anything important? Do you wish to add anything?

  Should dredge the bar out.

PILOT INTERVIEW FORM

SUBJECT # 21 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Greenville, Mississippi

ACTION: Ride Tow ________, P to P Interview ________, Tel. Interview X

VESSEL NAME and HP: Jason or Argonant
10,500 HP

1. How many years

   a. As a towboat Captain 4 years
   2 years

   b. How long have you been operating thru this segment of waterway 6 years

2. How did you become a towboat Captain? How did you enter the profession?

   He started as a deckhand 23 years ago.

3. What are the worst bridge(s) in your experience?

   Greenville at medium stage.
   Vicksburg at high water stage.

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

   HP 6400 to 10,500

   No. of screws? 3

   No. of types of rudders? 3 steering
   6 flanking

   b. Barge:

   Push X Tow ____ Hip ____

   Integrated? No, a barge line

   No. of barges? ____ to 40

   Width of tow? 8 (280') southbound

   6 or 7 (long & wide) Northbound — Length of tow? 5 (975') southbound

   Loaded/unloaded trips? ____

   Loaded southbound - 6 loaded long mixed northbound, 7 long empty

Barge Dimensions

	L	W
Standard	175'	26'
Jumbo	195'	35'

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

5 long (975')
8 wide (280')
10,500HP

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current.

  c. Weather clear, daytime, light wind.

  d. Proceed downstream current 4 - 5 MPH

  e. Describe passage. Circled numbers refer to chart locations.

  Downstream:

  At 5 slow to half speed.
  At 3 align stern with Vaucluse Point light.
  Between 1 and 2 come full ahead and aim for the green lights under the center of the bridge.
  When a couple hundred yards from the bridge steer to the right to avoid getting the bow of the tow in slack water which at 1 above the bridge on the left descending shore.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

At S (Mile 536.5) call for northbound traffic. At mile 534.4 (Island 84 lower light) call again.

Aim bow of tow at the next red buoy and the current will keep you from hitting them.

Try to line the stern of the boat with the vaucluse light once you are below 3.

g. Describe what makes this a difficult/easy passage?

1. False points on the right descending shore revetment cause eddy currents.
2. The slack water above all the sandbars.
3. The periodic absence of buoys caused by the Coast Guard's failure to respond to the rise and fall of the river.

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids bright beam lights at both Vaucluse and Anconia
2. wind and current information at bridge NO
3. additional electronic aids NO
4. change in channel Service the buoys around the bridge.
5. change in bridge NO
6. other

Explain: Reflective tape on the bridge pieces: red on left descending, white on right descending, and green tape just above the green lights on the bridge.

Case 2 River High (specify) 53 feet stage

- How does operation differ from Case 1?
After passing the Greenville side revetment you go around the left of the dikes and proceed toward the center span of bridge.

g.3. continued.... Natchez district is the lone exception.

Case 3 ~~Loaded~~/Light (specify)

- How does operation differ from Case 1?

  About the same but you are mindful of the red buoys.

- How does operation differ from Case 2?

  Do the same thing.

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

NO

GENERAL DATA

- Operating Downstream
  1. How is steering (directional control) affected by:
     a. Going faster than current.

        Tow has greater tendency to slide always go faster for bridge.

b. Do you ever go the same speed as current (drifting)? Describe situation.

Only if you want to flank.

c. Do you ever go slower than current? Describe situation.

Not normally.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

No, but it takes a while sometimes.

3. Describe stopping procedure.

Reverse the engines and maneuver to bank.

4. Assume your tow is out-of-shape i.e., 30^{0} to normal track?

a. Describe actions taken to correct, when loaded and when light.

You either flank or steer out of it.

Normally you have to flank with a loaded tow, but a light one can be steered around.

5. What is cause of out-of-shape?

Either current around a bend or wind on empties. You need to keep a rudder on them.

6. Why more accidents at night?

Less visibility.
Poorer judgement.

7. Is wind a problem for light tow? loaded tow?

Light;yes
Loaded;No

8. Where is pivot point?

Two barge lengths out from bow of boat (390ft) boat is 190 ft long.

- <u>Operating Upstream</u>

  General discussion regarding bridge passage and upstream operation.

  1. How does upstream operation differ from downstream in regard to:

     a. Bridge approach - describe

        You must cock the head of the tow to the right ascending bank (red buoys) to fight the left hand set.

     b. Steering and control of tow

        Steers faster because you are going slower with empties. (7 long, 6 wide) steers slower when loaded (6 long, 7 wide).

     c. Make-up of tow

        6 by 7
        or 7 by 6

- Have we missed anything important? Do you wish to add anything?

  The gage on the Greenville bridge has not been updated in 3 months.

PILOT INTERVIEW FORM

SUBJECT # 22 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Vicksburg

ACTION: Ride Tow__________, P to P Interview__________, Tel. Interview X

VESSEL NAME and HP: Mostly 5000 HP Boats - Steel Patriot (6800 HP) Latest Boat

1. How many years

   a. As a towboat Captain since 1942

   b. How long have you been operating thru this segment of waterway 1942

2. How did you become a towboat Captain? How did you enter the profession?

   Started on deck-worked up to steersman - got pilot's license

3. What are the worst bridge(s) in your experience?

   Greenville and Vicksburg at high water

   Greenville buoys should be checked more often as a function of river stage

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 5000 to 6800

      No. of screws? Twin

      No. of types of rudders? 2 steering 4 flanking

   b. Barge:

      Push X Tow ______ Hip ______

      Integrated? Varies

      No. of barges? 20 to 25 (195' x 35')

      Width of tow? 4 wide-up, 5 wide-down river

      Length of tow? 1100' overall

      Loaded/unloaded trips? loaded both ways

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

See 4

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current. 10' stage 4-5 mph

  c. Weather clear, daytime, light wind.

  d. Proceed downstream loaded

  - Sailing line shown on original chart is accurate for normal (10' stage) river conditions.
  - With heavy load (25 loaded barges) flank at mouth of Yazoo River 3*
  - When flanking at 3 stern is over toward point (Delta point), bow along sailing line
  - Floating with speed of current while flanking around bend in vicinity of 3.
  - Come out of flanking position at 2 and drive for right hand pier of bridge.
  - Terrific left-hand draft in bend
  - Black buoys outline bar - see chart
  - Left-hand draft increases as for approach bridge
  - Strong left-hand draft starts above 1

* Circled numbers refer to chart locations.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Black buoys
Distance off shore
Stack (water tank) north of Yazoo River
Red light on tank at night - used as a range
Cypress bunch light
Radar - on all the time - especially at night

g. Describe what makes this a difficult/easy passage?

High water
Left-hand draft

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain:

Maintain and adjust position of black buoys
* Retroreflective material on bridge piers.
Brighten navigation lights on bridge

Case 2 River High (specify)

- How does operation differ from Case 1?

30' stage is high water.
Run "point way" - Kings Point light to Delta Point (see chart),
200 years off Delta Point - hold on oil tank between 1 & 2,
line up on right-hand pier, middle of river between 1 & 2,

*Retroreflective tape installed on Boot Point bridge by towboat crew.
Still good after one year. Very satisfactory.

Case 3 ~~Loaded~~/Light (specify)

- How does operation differ from Case 1?

  Middle of river is best route.

- How does operation differ from Case 2?

  Stay in middle of river - much more control when light

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

Has been thru bridge with other pilots who came close but never hit bridge.

GENERAL DATA

- Operating Downstream

  1. How is steering (directional control) affected by:

     a. Going faster than current.

     Must go faster for control

b. Do you ever go the same speed as current (drifting)? Describe situation.

Flanking a bend

c. Do you ever go slower than current? Describe situation.

This can be done - called "flanking bridge", he has seen it done but never done it himself.

Done quite often years ago when low HP.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

Yes, on occasion

3. Describe stopping procedure.

---

4. Assume your tow is out-of-shape i.e., 30° to normal track?

a. Describe actions taken to correct, when loaded and when light.

- Back and flank if down in bend at 2
- Eddies along shore (see chart) - if bow in eddy and stern in current - you've had it

5. What is cause of out-of-shape?

See 4

6. Why more accidents at night?
Harder to judge at night

7. Is wind a problem for light tow? loaded tow?

Problem for empty - 10 knots and up

No problem for loaded

8. Where is pivot point?
5 lengths - middle of 3rd barge
or 2nd barge out from towboat

• <u>Operating Upstream</u>

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

   a. Bridge approach - describe

   With low HP tow, current at 1 and 2 may set tow back down on bridge - during high water - see chart. Don't cross river at 3 if sufficient hp to round Delta Point

   b. Steering and control of tow

   c. Make-up of tow

   See 4.b

- Have we missed anything important? Do you wish to add anything?

Should ride tow to get best information.
Can't think of anything else.

PILOT INTERVIEW FORM

SUBJECT # 23 .

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Vicksburg, Miss.

ACTION: Ride Tow________, P to P Interview________, Tel. Interview X

VESSEL NAME and HP: Marilyn M II, 1800 HP

1. How many years

   a. As a towboat Captain 15 years

   b. How long have you been operating thru this segment of waterway 22 years - 15 as captain

2. How did you become a towboat Captain? How did you enter the profession?

   Worked his way up as deckhand. Helped captain by steering.

3. What are the worst bridge(s) in your experience?

   Morgan City is bad when river is high.
   Greenville and Vicksburg are treacherous.

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 1800 to 3200

      No. of screws? Twin

      No. of types of rudders? 2 steering, 4 flanking

   b. Barge:

      Push X Tow ____ Hip ____

      Integrated? Some are

      No. of barges? ____ to 8

      Width of tow? 50'

      Length of tow? 111' to 264' (284' EXXON)

      Loaded/unloaded trips? Mixed tow but generally empty downstream.

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

11 barges

100 - 150' wide

600 - 900' long

1800 HP

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

a. You are operating the typical tow previously described.

b. The river stage is normal, specify stage and current.

c. Weather clear, daytime, light wind.

d. Proceed downstream

e. Describe passage. Circled numbers refer to chart locations.

Downstream:

At 5 with a large tow cut speed back to half ahead.

Float and line up tow with bridge braces.

Come full ahead at 1 and pass thru the second span out from the Vicksburg side.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Call for northbound traffic on radio.

g. Describe what makes this a difficult/easy passage?

The way the current comes thru the bridge

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids
2. wind and current information at bridge
3. additional electronic aids
4. change in channel
5. change in bridge
6. other

Explain:

Never had any problems there

Case 2 River High (specify)

- How does operation differ from Case 1?

About the same except kill out all your headway before 5.

Case 3 ~~Loaded~~/Light (specify)

- How does operation differ from Case 1?

  May not have to slow down at all

- How does operation differ from Case 2?

  Just kill out the headway

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

No

GENERAL DATA

- Operating Downstream
  1. How is steering (directional control) affected by:
     a. Going faster than current.

        Best control when you have a steady push.

b. Do you ever go the same speed as current (drifting)? Describe situation.

   Only when getting rid of headway, directional control is poor.

c. Do you ever go slower than current? Describe situation.

   Not normally.
   Would only occur when flanking to get lined up.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

3. Describe stopping procedure.

4. Assume your tow is out-of-shape i.e., 30^{o} to normal track?

   a. Describe actions taken to correct, when loaded and when light.

5. What is cause of out-of-shape?

6. Why more accidents at night?

7. Is wind a problem for light tow? loaded tow?

8. Where is pivot point?

   On a loaded tow somewhere between the bow of the boat to the midpoint of the tow.

- Operating Upstream

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

   a. Bridge approach - describe

   b. Steering and control of tow

   c. Make-up of tow

- **Have we missed anything important?** Do you wish to add anything?

  On the GIWW the boats and barges should have lights that can be seen for 2-3 miles.

PILOT INTERVIEW FORM

SUBJECT # 24.

PURPOSE (Introductory Statement Guideline)

We are making a study to document the information, skills and equipment needed by pilots and captains to navigate difficult sections of the inland waterways. We believe that experienced captains/pilots are the best qualified people to tell us what is needed. That is why we have requested this interview with you.

BACKGROUND

As you probably know the (name) bridge has had more than its share of accidents with tows and we are trying to find out why. We have studied the accident reports at this bridge and have learned a few things about the cause of accidents but, more important, we do not have any information on how to navigate thru this section of waterway safely. This is the reason for our interview with you today - to attempt to write down your detailed description of a safe passage thru the bridge and to document all the knowledge that you can give us about this section of waterway.

To begin the interview we would like to ask you some questions about your experience.

EXPERIENCE

Specific questions to be answered:

BRIDGE: Vicksburg, Miss.

ACTION: Ride Tow______, P to P Interview______, Tel. Interview x

VESSEL NAME and HP: Jason or the Argonaut 10,500 HP

1. How many years

   a. As a towboat Captain 6 years

   b. How long have you been operating thru this segment of waterway 6 years

2. How did you become a towboat Captain? How did you enter the profession?

   Started as a deckhand 23 years ago.

3. What are the worst bridge(s) in your experience?

   Greenville at medium stage.
   Vicksburg at high water stage.

4. What kind of tow configurations have you operated in the past year?

   a. Towboat:

      HP 6400 to 10500

      No. of screws? 3

      No. of types of rudders? 3 steering, 6 flanking

   b. Barge:

      Push X Tow ____ Hip ____

      Integrated? No

      No. of barges? ____ to 40

      Width of tow? 8 (280ft) southbound

      Length of tow? 5 (975ft) southbound

      Loaded/unloaded trips? Loaded southbound, 6 long

      Mixed northbound, 7 long

      barge dimensions:

standard	175' L x 26' W
jumbo	195' L x 35' W

5. What is a typical tow configuration for this waterway? (length, width, horsepower)

5 long (975')
8 wide (280')
10,500HP

NAVIGATION AND OPERATION

PROPS: Chart of waterway and bridge, marking pencil.

Case 1 Normal Environmental Conditions

- Instructions to interviewee:

  a. You are operating the typical tow previously described.

  b. The river stage is normal, specify stage and current.

  c. Weather clear, daytime, light wind.

  d. Proceed downstream, circled numbers are locations on chart.

River stage 15 ft.
Current 4-5 MPH

a. Start at 5

b. Reduce speed to half ahead and start punching (aiming) the head of your tow at the black buoys and then let the set push you around them.

d. After cutting speed to half ahead at 5 and punching at the black buoys (letting the current take you around them); steer the tow around until you are between 1 and 2 judge the drift and then go full ahead under the bridge.

f. What inputs do you use, such as navigation aids, radio, visual, etc.

Call at King's Point for any Northbound Traffic.
Do the same at Centennial Point (Mile 438.0)

g. Describe what makes this a difficult/easy passage?

It is hard to keep in shape in the bend.

h. What would be helpful in guaranteeing a safe passage such as?

1. additional navigation aids--Yes
2. wind and current information at bridge- No
3. additional electronic aids - No
4. change in channel - No
5. change in bridge - No
6. other - No

Explain:

1. It would help to keep up the gage board (Day Mark)
2. The Cyprus Bunch Light could be brighter
3. Pilots could use reflective tape on the piers and green tape above the lights on the span

Case 2 River High (specify)

- How does operation differ from Case 1?

1. You have to come down in the middle of the river
2. At 2 you have to hold the bow of the tow on the 3rd or 4th channel pierspan out (as the current sets you to the left)

Case 3 ~~Loaded~~/Light (specify)

- How does operation differ from Case 1?

  No difference

- How does operation differ from Case 2?

  You would not have to hold it out in the middle of the river as much

Case 4

"Think of the last time you were involved in or witnessed a difficult situation in approaching or passing through this bridge (or these bridges)."

"What were the circumstances leading up to the situation?" (Let respondent answer freely).

No

GENERAL DATA

- Operating Downstream

  1. How is steering (directional control) affected by:

     a. Going faster than current.

        Tow has greater tendency to slide. Always go faster than bridges.

b. Do you ever go the same speed as current (drifting)? Describe situation.

Only if you want to flank.

c. Do you ever go slower than current? Describe situation.

Not normally.

2. Do you ever operate in a current so fast that you cannot stop tow with propulsion system?

No, but it takes a while sometimes.

3. Describe stopping procedure.

Reverse the engines and maneuver to bank.

4. Assume your tow is out-of-shape i.e., 30^{o} to normal track?

a. Describe actions taken to correct, when loaded and when light.

You either flank or steer out of it.

Normally you have to flank with a loaded tow, but a light one can be syeered around.

5. What is cause of out-of-shape?

Either current around a hand or wind or empties.
You need to keep a rudder on tham.

6. Why more accidents at night?

Less visibility

Porer judgement

7. Is wind a problem for light tow? loaded tow?

Light - yes
Loaded - no

8. Where is pivot point?

- Operating Upstream

General discussion regarding bridge passage and upstream operation.

1. How does upstream operation differ from downstream in regard to:

   a. Bridge approach - describe

   1. Watch the draft
   2. After going thru the bridge keep the tow aligned into the current

   b. Steering and control of tow

      Good

   c. Make-up of tow

      6 long (jumbos ≃ 195 ft)
      7 wide (jumbos ≃ 35 ft.)

- Have we missed anything important? Do you wish to add anything?

  No, but keep the aids current

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